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THE AMERICAN GAS LIGHT JOURNAL

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BRIEFLY TOLD.

AN ADVANCE HINT FROM THE MANSFIELD MEETING.—Mansfield, Ohio, March 21.—March is fickle in the variety of weather that makes or mars her days, and I am sorry to have to say that yesterday (Wednesday, 20th) was of the doubtful sort. I presume that General Greely would officially designate its character as "cloudy, with light rains;" in any event, had he used those words, he would have been in the right. Mansfield, however, is not a bewilderingly large place—although it is a pretty one—and does not offer any very great hardship to the traveller in the matter of getting about from place to place within its boundaries. However, the sojourner who trusted himself to the good judgment and carefulness of the persons in charge of selecting a hotel and place of headquarters for those who were to attend the sessions, made no mistake in such reliance; and thus it was that a rainy day had no great terrors for the clans. In respect to the attendance, it must be written down that it was most flattering to the pertinacity of the Ohio gas man; for he was out in good numbers, and was as enthusiastic as ever over the prospects of the Buckeye State's gas business in general and the unbounden success of the Ohio Gas Light Association in particular. The attendance of visitors from other States was not pronounced, although Pennsylvania, Illinois and New York made a good showing. Ex-President McMillin was an absentee, and there can be no doubt about it that he was missed, for inquiries for him were frequent. It must have been something particularly pressing that sent him to New York at a time when all the gas world of Ohio was concentrated within the limits of Mansfield, but Columbus proper was nevertheless ably represented in the convention. The programme, as arranged for the first day, was fairly well adhered to, although I fear that there was really too much business to be disposed of in the time allotted. And this causes the remark that Secretary Butterworth must have been in a particularly pessimistic state of mind when, in his circular dated Jan. 15, he partially gave vent to the fear that the "drafting" powers of the Executive Committee would have to be appealed to in securing a sufficient number of papers. The President's address was well received; and there can be no doubt about it that he has the courage of his convictions. Outspoken views being vastly more valuable, and in the end more advantageous to the utterer than the whisperings along the corridors, I have no doubt that many who dissented from some of the President's conclusions nevertheless freely accorded him that applause which frankness wrings from its less ardent supporters. There is much in the address about which all can join hands over, and it would be hardly fair here and now to go into its details. The papers on the first day were all in good point, and that presented by Mr. Wilkiemeyer, of Portsmouth, was especially well prepared. If he will pardon me, I think Portsmouth's representative in the Association would grace the Buckeye Bar; but as this would mean probably that he would not then be a gas man, I may add we ought to be pleased that the Bar is the loser, since the gas fraternity is the gainer. I need not say that the feeling prevalent over the success of the '89 meeting as determined by the expressed individual judgments of those who have so far participated in it, is towards congratulation. The members have been well repaid for their trouble, and the companies shall be more than repaid later on by the fruit from the seed sown in Mansfield. That the Association is to

still further extend its field of useful influence is well shown in the addition, so far, of 11 names to its membership roll. In closing this necessarily brief and *ex capite* mention of the first day's proceedings, I would do but scant justice to the occasion were I to omit reference to the gas apparatus exhibition. It augurs well indeed for the future of the gas trade when at such short notice such an admirable display of articles concerned in its use can be gathered together. Many prominent firms are represented by specimens of their best wares, and the harmonious arrangement of the exhibit reflects the greatest credit on those who are responsible for it. It was a happy idea, in the first place, and the degree of its effectiveness was only measurable or to be measured by the quality and amount of preparatory labor devoted to it. The result is that the Association for ordering it, the gentlemen who arranged for it, and the manufacturers who contributed to it, are to be heartily congratulated over the success of their joint labors. And in this connection I think it proper to add that Superintendent Harris, of the Mansfield Gas Light Company, ought to have especial praise for his part in the affair.—***

Has the Thomson-Houston Company a Wicked Partner?—Were either of the distinguished gentlemen whose names constitute the corporation title of the huge electrical supplies concern that, from its home in the Bay State, seeks to cover the globe with its goods, able to perform all the duties incident to its trade, this question would not stand for a moment. But as the principals are responsible for their agents' doings, refuge cannot be had from the query on the ground that they [the principals] are "always good." The people of Havana, Cuba, were said to be hungering for electric lighting, and in order to appease their appetites the Spanish-American Light and Power Company asked for permission to do the necessary catering. Although this Company had hitherto devoted itself chiefly to gas making, its proprietors saw no good reason why they should not, in the capacity of a versatile *chef*, add a *releve* to the ordinary lighting bill of fare, and the rulers of the ever-faithful isle agreed to the suggestion. Armed with authority they invited proposals from the thousand-and-three electric lighting appliances installers, all to enter the contest on the same footing, merit, together with other proper considerations, to be the sole factors in the ultimate matters of a selection and a contract. In due time, after patient review and studious sifting, the contest narrowed to a choice between the Westinghouse and the Thomson-Houston systems; and the final verdict, together with the contract, was secured by the former. So far so good. When the work of installation had been completed and the new lighting service had been commenced, the newspaper readers of the United States were treated in their daily news *melange* to cablegrams from Havana all berating the service rendered from the electric annex of the local gas plant, and it was also noticeable that these criticisms managed to convey the idea that a Westinghouse type of plant was the one in fault. This would be all right enough were it so; but those in position to know, and who have no desire to say a good or bad word for either the Thomson-Houston or Westinghouse systems, say that apart from the difficulties inseparable from the first few days' working of a new and complex apparatus, no fault could be found. In fact, on the other hand, that "all Havana" was fully satisfied with its electric light supply. From other facts known to us in connection with this matter, we might remark that it seems likely that if the Thomson-Houston Company had secured the contract for furnishing an installation to the Spanish-American Company no murmurs of discontent would have been wafted to us about defective service. And we think so from the simple fact that an agent of the Thomson-Houston Company, while endeavoring to secure such a contract, was more than cognizant of an attempt on the part of the "International" Thomson-Houston branch to secure a concession from the Havana authorities for the right to supply electric light in that city. It is quite rarely the case that two birds are killed by a single stone; so in this case, also, the attempt to have the cake and eat it was frustrated by the authorities, who refused the concession, and both branches of the Thomson-Houston concern were foiled. It was this state of things that prompted us to ask about the existence of wicked partners in the Thomson-Houston Company; and remembering the news despatches, we might have pertinently inquired whether the Thomson-Houston folks also maintain a literary bureau? We leave the matter with the simple intimation that these adjuncts are oftentimes "loaded," and that they are liable to explode at inopportune moments.

To-Day a special meeting of the stockholders of the Boston (Mass.) Gas Light Company will be held to alter the by-laws, and then is to follow the annual meeting, adjourned from early this month. To-morrow, or very soon thereafter, the syndicate will pay over the $6,150,000 agreed on as the price of the 5,000 shares in the Boston Company. We understand that the Board of Directors is to be increased to seven, and that two of the retiring Board—Messrs. N. J. Rust and Louis Curtis—will be requested to remain in the interests of the bondholders. It is presumed that the balance will be named in the persons of Messrs. Samuel Little, E. C. Fitz, H. C. Gibson, W. E. L. Dillaway, and J. E Addicks. Quite likely in the near future the Board shall consist of nine persons. Mr. M. S. Greenough is to retain his place as Managing Engineer, and Mr. C. P. Greenough will continue as the Company's counsel. Mr. F. P. Addicks is to assume the Treasurership, Mr. W. W. Greenough having peremptorily declined to remain. And we are pained to think that the fraternity is to lose from active service such a man as Mr. Greenough is. However, his is properly the choice, and he carries with him to his retirement the sincerest respect of all, and the warmest regards of every member of the profession who has the pleasure of personal acquaintance with him. A delicate act on the part of the new proprietors was their invitation to Mr. Greenough to retain his present room and accommodations, notwithstanding the severance of his official relations with the Company.

In our item columns will be found an account of an application made to the Grand Rapids (Mich.) Common Council for the right to supply a fuel gas in that city, which, having received the necessary Councilmanic consent, was vetoed by the Mayor. We herewith present the Mayor's veto message in full:

"Mayor's Office,
"Grand Rapids, Mich., March 15, 1889.

"To the Honorable Common Council:—I hereby suspend the action of the Common Council in passing what is known as the Fuel Gas Ordinance.

"First.—While not opposed to safe fuel gas, legally introduced, or any other material designed to cheapen fuel or light, I cannot approve this ordinance, under our charter, in the form it was passed.

"Second.—That it permits the use of any odorless, poisonous, blue gas throughout the city absolutely without restriction. Such gas is destructive to human life, and is prohibited by statute in several States from use in municipalities.

"The protection to the city must necessarily rest entirely upon the express terms of the ordinance, and not upon the mere assertions of interested individuals outside the ordinance. If the verbal promises to use only approximately safe fuel gas are to be honestly performed, why not put them in their natural and proper place—the ordinance itself? There is where they ought to be.

"Third.—I am confident that under our charter the Common Council has no authority to grant an ordinance permitting the use of poisonous fuel gas in this city.

"The main purpose of this ordinance is admitted to be the supply of gas for fuel. At the time the charter was passed the use of gas was not known as a fuel, nor for any other purpose than illumination. A strict construction of the charter ought not to prevail so as to prevent new uses of harmless gas for fuel and other purposes; but when the gas proposed to be used is not safe, but is poisonous and dangerous, the conditions are altered, and the exercise of the charter powers should be confined strictly to such use as was known at the time the charter was passed.

"If the Council exceeds its authority in passing this ordinance, it will subject the city and the proposed Company to recover any damages which may result from the poisonous gas.

"Fourth.—That it grants a franchise to a corporation yet to be formed, with stockholders and capital unknown.

"Fifth.—That the proposed $15,000 bond would be a mere empty promise, giving the city no right to recover any substantial sum in case the grantees violate every word of the ordinance, as any injuries would be to individuals and not the city. The proposed bond only contemplates that the grantees shall carry out the provisions of a one sided, defective ordinance. It is worse than no guarantee—it is a delusion and a humbug. The guarantee should be in the ordinance itself.

"There are other objections, such as prices permitted in excess of those charged in other smaller cities, but those particularly mentioned seem sufficient. I. M. Weston."

The Maryland Meter and Manufacturing Company has been awarded the contract to build a 12 by 12-foot station meter in the new plant of the Cleveland (O.) Gas Light Company.

At the annual meeting of the Hamilton (Can.) Gas Light Company, old reliable, F. W. Gates, was re-elected President. Mr. James Cummings succeeds himself as Vice President.

Concluded from p. 347.

[OFFICIAL REPORT—REVISED BY THE SECRETARY.]

Nineteenth Annual Meeting, New England Association of Gas Engineers.

HELD AT YOUNG'S HOTEL, BOSTON, MASS., FEBRUARY 20 and 21, 1889.

SECOND DAY—FEB. 21—MORNING SESSION.

OPENING THE QUESTION-BOX.

The President—As all the papers have now been read, we will attend to the questions in the question-box. The first is:

(1) "*How can the pulsation of gas in mains, caused by gas engines, be prevented?*"

Mr. Nettleton—As I have been recently looking up this matter perhaps I can answer the question. Recently a governor has been brought out, and is now furnished with the Otto engines, which they say is an absolute prevention. They put on an argand burner close by a 40-horse power engine, and there was no pulsation to the burner. They put on the pressure gauge, and told me that the pulsation was less than a tenth of an inch of water.

(2) "*Is it customary for superintendents to pay for gas used at their homes?*"

Mr. Sherman—I do not know what the custom is in other places, but I have always paid for every foot of gas that I have burned, and I always expect to.

Mr. Coggshall—I pay for all the gas that I burn.

(3) "*How can small works utilize their gas liquor, with plenty of storage capacity, but no efficient scrubber to make strong liquor?*"

Mr. Learned—About three months ago I had some conversation with the manager of a chemical company with reference to the lucrative utilization of our liquor. We had quite a large amount of ammoniacal liquor, of about 4½ oz. strength, and the question was how to utilize it. They put in for me a concentrator which occupied a space of about 3 feet by 8 feet, and with this from the 4½ oz. liquor we get 36 oz. It varies from 25 to 36 oz. liquor. We sell it to them at a regular price. The apparatus was put in by them at their own expense. In our investigation of the matter we found one thing which seemed to be of interest, and that is that the liquor from the condenser and hydraulic main was 4½ oz.; and 30 per cent. of that was fixed ammonia. We made some experiments to recover it, but found that it was not profitable. It took about 45 cents worth of lime to get a dollar's worth of liquor, and then there was the labor to be added to that. So there was no advantage for us to utilize this fixed liquor. A sample of the liquor was taken from the standard scrubber, of 16 oz., and what surprised me was that in that liquor there was 98 per cent. of free ammonia, and 2 per cent. of fixed liquor.

(4) "*Can better results be obtained, and the retorts made to last longer, by having bye-pass valves on the hydraulic main, with or without exhauster?*"

Mr. Lamson—I think it is a very good thing to have a bye-pass valve There has been a great deal claimed for it, but I think that many of the claims have not been fully carried out.

Mr. Vanderpool—Perhaps the object of this inquiry is to know whether there is any saving by the use of bye-pass valves on the hydraulic main when you use an exhauster. I have never tried it without an exhauster, but we put on a valve similar to those used by Mr. Sherman, at New Haven—an ordinary bye-pass valve on top of the pipe—and have kept a very careful record of the results obtained, while running these retorts, off and on for a number of years. I think the result showed that there was some economy; that we made a little more gas from the coal; and that the candle power was somewhat improved. But even when running the exhauster very carefully, and keeping the same back pressure on the retort, we found that the durability of the retort was considerably lessened. On considering the expense of resetting, etc., we found that there was no economy in the long run, and we have not used them since.

The President—Are you troubled much with carbon?

Mr. Vanderpool—We found that carbon did not form so rapidly. We got more service out of the retorts while they were being used, but they were not so durable. In the long run we found that there was no economy.

(5) "*What is the proper way for estimating the cost of distribution of gas?*"

Mr. White—I have adopted a plan of keeping accounts at my works that differs from the plan I have found in use elsewhere; and it relates to this very point. I make a very careful estimate each month of the cost of the gas in the holder. I include the cost of everything which has come into the works during the month, whether it has been used to go into the gas or not. Our gas costs so much, for instance, in the month of January, because the Company expended during the month of January so much money. There is, of course, a credit given for the coal which is on hand, but I simply want to get at what the gas cost us for the month in that way. I then have a fixed method of estimating the cost of distribution, which includes every item outside of the manufacture of gas, even to the salary of clerk at the office and the salary of superintendent (which is divided in half between manufacturing and distribution), all taxes, interest, and every charge of that kind being put upon the distribution end. I arrive at my cost of distribution in that way. I consider that all the interest, taxes, salaries, purchase of new meters, and every item that is not absolutely a part of the manufacturing cost, belongs to the distribution, for the purposes of that statement. I then make another statement of the cost of the gas as it actually was. That is, if just so many pounds of coal are consumed, that is charged, together with the actual labor employed. In that way I get at the actual cost of the gas. The account may be a little more complex than some of you would care to go into; but, after all, there is a certain degree of satisfaction in knowing, at an early period in each month, just what your gas has cost during the preceding month, with everything possible charged against it. By this plan there can be no doubt but that you know just what that gas is costing. Then you have to separate the cost of actual manufacture from the cost of actual distribution. I feel there is nothing so foolish as for a gas man to deceive himself in these very essential particulars as to what his gas is costing him, but we do do it, as a rule, more or less. It is a most astonishing thing that if when talking with men as to the cost of their gas in the holders, when you pin them right down, ask for item after item, and whether that is in or out, you will find their statements vary in a most remarkable way. But you will find, when you get down to the actual facts, that most of the well-conducted works are producing gas for just about the same cost.

Mr. Vanderpool—What do you do at the end of the year?

Mr. White—I make a statement of the whole year's business.

Mr. Vanderpool—Do you charge, in the cost of the gas, the depreciation?

Mr. White—In the yearly statement I do. We make an average of what it has cost us, where we have had an experience of years, and average the results. If I cannot do that (as, for instance, during the first year that I have control of a plant), then I charge up the actual cost of repairs and extensions, and then add on a certain percentage—usually about 5 per cent.

Mr. Vanderpool—On the capital?

Mr. White—Hardly; I mean 5 per cent. more. I take the actual cost, whatever it has been for the year, and add 5 per cent. more for any variation.

Mr. Coggshall—I charge everything done at the gas works to the cost of gas in the holder. Every other expense (except taxes) I charge half to the holder and half to the distribution.

(5) "*Which will produce the largest number of candle-feet—a heat that will give a yield of* 8,000 *feet to the ton of* 2,000 *pounds, or that which will give a yield of* 10,000 *feet to the ton?*

Mr. Taber—I move that that question be left until the next meeting—until after Dr. Norton has given us another report as to what candle-feet means.

Mr. Harbison—I second that motion.

Mr. Taber—I might explain my object. Yesterday Dr. Norton expressed some little apprehension that we did not know of what the illuminants of gas consisted, or how they were evolved; and he promised to go further in the matter. If we have another report from him next year it may give us some information as to what is meant by candle power and candle-feet. I do not think that we know to-day. Therefore I prefer to leave that question until next year.

Mr. Harbison—I move to amend—that it be reported on by the President-elect (Mr. Taber) at the next meeting.

The motion prevailed.

APPROPRIATION FOR EXPERIMENTS.

Mr. Lamson—I was not here at the beginning of this session, and I would like to ask the Treasurer about how much money the Association has on hand?

The Secretary—I think, at the end of this meeting, after paying all expenses, there will be about $500 in the treasury.

Mr. Lamson—I feel that we ought not to close this session without taking some further notice of the papers that have been read than by a general vote of thanks to each member who has read a paper. I have been impressed by the papers, as showing a gradual increase of scientific knowledge in the various members of the Association. The standard of the papers I consider to be very high, and I have been very much pleased to find men are growing up in the gas business who are willing to devote their time to study and to careful investigation. I believe that the Association ought to take some method to increase the number of papers which shall be read, and especially if we can procure such papers as were read at the last and this meeting of the Association. The offer of prizes does not seem to have accomplished much; and fines from members who do not read papers accomplish less. I therefore move that the Directors be empowered to expend $100 in some such way as this: If any member of the Association cares to carry on an investigation or an original research in matters relating to the gas business, and wishes assistance in purchasing apparatus for experiments, he may apply to the Directors and they may give him a sum not exceeding $100 for such apparatus. The money should be given upon the condition that the result of the investigation shall be given to the Association at its next meeting. I think this would show an appreciation on the part of the Association, and I believe that good results will follow. I was very much pleased with the paper read yesterday by Mr. Jones and the report of Mr. Prichard. I think they were of very great value indeed. I move the Directors be given liberty to spend $100 the coming year at their discretion, in helping members to buy apparatus for original investigation.

The President—And for lectures?

Mr. Lamson—No; not for lectures. While I believe that the lecture yesterday was a good one, I do not believe that that lecture is of the nature needed by this Association. While I believe it is all well and good for a few scientific men to know that these very delicate compounds go to make up a more common compound in gas, yet I do not believe that it is of any very great use to us. I think that experiments such as have been made by Mr. Prichard and Mr. Taber, and the careful analyses and experiments with the apparatus made by Mr. Jones, are what we want; but I think that a too careful, a too minute a series of experiments, such as may be made by a Professor in a college, are not just what we want.

Mr. Harbison—I quite agree with the suggestion of Mr. Lamson, and I have great pleasure in seconding his motion. I think it is a step in the right direction. [Adopted.]

Stenographic Reports.

The Secretary—There is only one other matter that I know of to be brought before the Association, and that is the report of the Directors in regard to the employment of a stenographer hereafter. That matter was left to the Directors yesterday for further consideration, and they now unanimously report the following:

"*Resolved*, that any journal, whose application is approved by the President and Secretary of this Association, may have the privilege of taking stenographic reports of the meetings, such reports to be revised by the Secretary before publication."

Continuing, the Secretary said: I have been asked to state that the Directors understand that the adoption of this resolution does not in any way alter our relations with the American Gas Light Journal, but that that Journal still continues to be the official organ of the Association, and will continue to send its stenographer here to make the reports.

Mr. Harbison—Do we understand the matter in this way: That the American Gas Light Journal will do as they have been doing for years—send their own stenographer, at their own expense, to make the reports, that Journal remaining the official organ of the Association; but that any other journal may, with the approval of the President and Secretary, also have the privilege of sending a stenographer to make reports, at their own expense, but that such reports are to be revised by the Secretary before publication. Is that the way we are to understand the resolution?

Mr. Nettleton—Yes; that is it.

Mr. Harbison—Then I move the adoption of the resolution recommended by the Board of Directors.

[Adopted.]

Report of Committee on Memorial to the Late Samuel Fowler.

Mr. Hallett—The Committee to prepare a memorial on the late Samuel Fowler present the following minute:

The Association recalls at this time the memory of one of its active members, Mr. Samuel Fowler, General Manager of the Westfield (Mass.) Gas Light Company, from its organization, in 1860, to the time of his death, which occurred July 30, 1888.

Mr. Fowler joined the New England Association of Gas Engineers soon after it was organized, and was a regular attendant at its meetings. He was a man of cultured mind, of a thoughtful and reserved nature, was well read in the various processes of gas manufacture, and always met his friends with a cordial greeting.

Mr. Fowler was interested both in home and State educational work. His many friends and associates realize their loss in his death, and desire to place on the records of this Association their tribute to his many good qualities.

J. L. Hallett, D. W. Crafts, } Committee.

Mr. Harbison—I move that the report be accepted and spread upon the minutes of the Association.

(The motion was carried by a rising vote.)

Engagement of Lecturer.

The Secretary—The Directors would like to know if it is the wish of the members to engage a lecturer for the meeting next year. The Directors took action this morning looking to having another lecture next year, hoping that Dr. Norton would carry on his experiments during the year, and then report the results of his investigations. I myself think with the experience he gained here yesterday and from the discussion which followed that his investigations will take a somewhat different turn, and that his lecture next year will be more practical and less purely technical and scientific.

Mr. Prichard—I think we can spend $50 to no better purpose than by employing some such lecturer as Dr. Norton to appear before us another year. Certainly, he has gathered much knowledge, and his investigations in another year will be far ahead of those of the past year. As he said, there is no one point in the manufacture of gas of which we know less about than we do of the composition of the illuminants. If we are to continue this investigation it is desirable to have some such man as Dr. Norton take the lead. We have no chemists so experienced as he who are able or have the time to follow out these things. It is imperatively necessary for us to keep ourselves posted as to the different kind of enrichers, in order that we may know which is the best for our purpose, and how we may handle them in order to get the most economical results. If you take any two people who have used naphtha or other oils, they will vary in their statements of results, and they will differ as to the mode of use; and we need to find out accurately what is best for us to do. I see no way to get this information except by employing some man possessed of the requisite scientific knowledge, and having the time to devote to it, to carry out the investigations.

The President—I think it will be well to let the Board of Directors do as they think best in the matter.

Mr. Cabot—I move that the matter be left with the Board of Directors, with power.

Mr. Harbison—I think it fair to make the suggestion to the Board of Directors, in connection with this matter, that the Professor in continuing his investigation should visit the gas works in his vicinity which are using different kinds of enrichers, in order that he may look at the matter practically, and not simply from a theoretical standpoint.

Mr. Lamson—I believe in having some scientific man give a lecture, and think that the matter had better be left to the discretion of the Directors. I think they ought to direct him in the line of his work, so that he shall not go into any very remote researches which may be of almost no practical use to anyone.

Mr. Cabot's motion was adopted.

Increase to Salary of Secretary.

Mr. Taber—I propose that we accompany our usual vote of thanks to the Secretary for his untiring efforts in behalf of the interests of the Association with something a little more substantial. If he has succeeded in prevailing upon the directors of any of our Companies to pay our expenses here, we certainly ought to be thankful; but, whether we are thankful for that or not, we are thankful to him for his active exertions which have made this meeting one of the most entertaining and instructive, and one offering more good solid nuts to crack than any we have had for a great while. That has largely been owing to the exertions of the Secretary. I move that the salary of the Secretary and Treasurer be raised to $200 per year, instead of the $100 which is now paid him.

Mr. Harbison—In seconding that motion I can speak from experience in connection with the duties of the Secretary's office during the two

years in which I had the honor to occupy the chair which you, Mr. President, have so ably filled during the past year. From a money point of view, for the time spent, and the wear and tear in connection with the business of the Association, $200 would scarcely be a drop in the bucket. It is not an affair of money at all; it is a question of honor—a matter of duty; and that is the way I know that the Secretary looks at it. You know something from your year's experience and labors in connection with this meeting as to the work necessary to be done by the Secretary; and I know that our meeting would fall flat if we had an inefficient man occupying the position of Secretary and Treasurer of the Association. I hope that when this motion is put it will be adopted by a rising vote—there is no question about its being a unanimous one.

(The motion was unanimously adopted, by a rising vote.)

The Secretary—I am exceedingly obliged to you, gentlemen of the Association, for the pleasant way in which you have met my efforts to make the meetings of the Association a success. For the increase in salary I can only express my thanks. It is entirely a surprise to me, as I had not dreamed that it would be thought that the Association could afford to pay a larger sum than was paid last year. As my friend Harbison has said, the question of salary has not come in in connection with my work. Of course, as you know, the active work in all these gas associations devolves on the Secretary; and while I have been in office, and while I may remain in office, it has been and will be my endeavor to make these meetings as great a success as they can possibly be made. Perhaps you have noticed—and I hope I am not deceiving myself in thinking so—that the meetings have improved in tone each year as we go along. I believe that with proper efforts on the part of members we can make our meetings second to none. We have a goodly number of members, and we have the ability; and if each member will only make an effort to prepare a good paper occasionally, and illustrate it with experiments or drawings, I believe that the meetings of the New England Association can be made as successful as if not more successful than any others that are held. It is that which I have in view, and it is that which we all ought to have in view. For your kindness, for your consideration, for the willingness with which you all have supported all I have done, I thank you most heartily.

Votes of Thanks.

Mr. Allyn—As our duties on this occasion are nearly performed, it seems proper that we should express the satisfaction that we have received from the very able manner in which the duties of President have been performed during this session. I therefore move that the thanks of the Association be tendered to our very able President for the efficient and impartial manner in which his duties have been performed.

Mr. Taber—Gentlemen, I take up the gavel which our worthy President has laid down in order to put the motion which has been made and seconded, that a vote of thanks be given the President. I assure you I wish that the vote was not to be so seriously put, as I do not agree with it at all. It is a day of surprises. He ought to have remained in the office for another year. But being as it is, I ask all who are in favor of that motion to rise, and thus express your satisfaction with and gratitude to our retiring President.

(The motion was unanimously carried by a rising vote.)

The President—Gentlemen, I thank you for the compliment, and for your very kind expression of approval. I assure you I appreciate it.

The Association then adjourned.

London Gas Testing.

The current meeting (ordinary half-yearly) of the shareholders in the South Metropolitan Gas Company, London, Eng., was quite harmonious. And it would be difficult to find a reason for an obverse remark concerning it. The Company had been prosperous in the six months reported on, and the maximum rates of dividend were declared; hence there was every cause for congratulation. Mr. George Livesey, the Chairman of the occasion, in moving the adoption of the report and recommendations, delivered a most felicitous address—it, however, is quite natural for him to speak in harmony—and we regret that lack of space prevents us from reproducing it in full. We take opportunity, though, to place before our readers his remarks on some of the perplexities connected with the official testing of London gas. He said:

I now come to a matter I would rather have avoided touching upon—the question of gas testing. But if I did not refer to it it might be said that the Company feel that they are not dealing fairly and justly by the public, and therefore the less said the soonest mended. But we do not feel that. You may have seen that the Company have been summoned before a magistrate and fined 40s.—four 10s. fines, two for Lambeth and two for Woolwich. The Solicitors said, "You can do nothing before the magistrate." The chief gas examiner is absolute, and all the magistrate can do is to impose a penalty, which is legally 40s. for a deficiency of half a candle. He reduced it, however, to 10s. in each case. The Solicitor said, "You had better be quiet, then nothing will be said about it." We said, "We do not accept that advice, because by doing so it would be an admission that we are in the wrong, and have supplied gas of a lower quality than the Act provides." We declined to accept any such position, because we are satisfied that we have supplied gas of the proper quality. I may say that it is our policy and to our interest to do so. We take no credit for doing right and for supplying gas of a uniform quality. If we supplied inferior gas on any day customers would find it out, and we should have letters of complaint sent to us. If we supply gas of higher quality, then consumers say it is smoky, because their burners are not adapted to consume gas of a higher quality. In Scotland, where gas of higher quality is burned, special burners are used for the purpose. But if you burn high quality gas with the ordinary burner in London, you get a smoky flame, and complaints are made. It is therefore to our interest, and to the interest of the officers of the Company, to supply gas of as nearly uniform quality as possible—about 16½ candles. But who can say what a candle is? The Parliamentary sperm candle of six to the pound ought to burn 120 grains an hour. But it does not exactly; it varies up and down. It is supposed by the Act of Parliament that the candles are uniform; but it has been proved to demonstration by the officers of the Metropolitan Board of Works, by the Referees, and by everybody who has investigated the matter, that while one candle will give a certain amount of light another candle will give a different light, and that the same candle will vary in the quantity of light given from time to time. For instance, you might on one occasion set up 15 candles and find them equal to a given gas flame. On another occasion you would find the same gas flame equal to 18 candles; so that the vagaries in the candles and the variations that ensue by the use of candles will show an apparent difference in the quality of gas of not less than 15 to 16 per cent. sometimes. Now, what is necessary? One of the Referees stated that the tester was to use his judgment in the selection of his candles. If a certain candle does not appear to be burning properly, though legally right according to the Act of Parliament, he changes it and takes another. I have here a series of testings made by the testers. I have taken them at random. On one day the test was 16.2 candles. The tester might very well say he makes three consecutive tests in a day. He might say, "That about accords with the quality of the gas, as it appears to me by looking at the flame." The next test is 18 candles. "Oh," he might say, "this must be wrong; this is not 18-candle gas. I must change the candle." He then takes another candle, and the gas flame then comes out 15.9, and by striking an average he gives a return of 16.7 candles as the quality of the gas on that evening. It stands to sense that a variation is impossible of upwards of 2 candles during the same evening. Take another instance. The first test was 18.7. "Oh," says the tester, if he uses his judgment, "these candles must be wrong." He changes them, and the next test comes out 17.1, and the third 16.1, a difference of 2.6 candles in the three testings, giving an average of 17.3 in the quality of the gas. I should say that 17.3 was rather a higher average than it ought to be. You can easily see when we have such a standard as this that it is utterly impossible to know where we are. It is as if a tradesman were measuring a certain amount of cloth. He says, "This cloth looks a yard wide." He takes a measure and says it is wrong, and then takes up another measure 3 inches shorter, and measures the cloth, saying, "This is just a yard." That is what the candle tests amount to. I am glad to say it is probable that good will come out of evil. So far as we are concerned, our own tests (for which we were fined) recorded 16¾ candles in four tests in a day, whereas the official record was 15.4, or rather more than ¾ candle below standard. The Metropolitan Board of Works make 2,000 testings of our gas in the year. There are six testing stations, and a test is made at every station once a day; and when I tell you that these deficiencies happen about once a year you will either say we supply very good gas of uniform quality, or that the gas testers have very sound judgment as a rule in the selection of candles.

Many of the storekeepers in the North End district of Boston have been greatly disturbed over the rumor that the North station of the Boston Gas Company was to be shut down immediately after the transfer of the old Company's property to the syndicate. Mr. Greenough, however, asserts that he knows nothing about such a project; and he ought to know all about it.

Description of a Large Water Gas Apparatus.

By Frederic Egner.

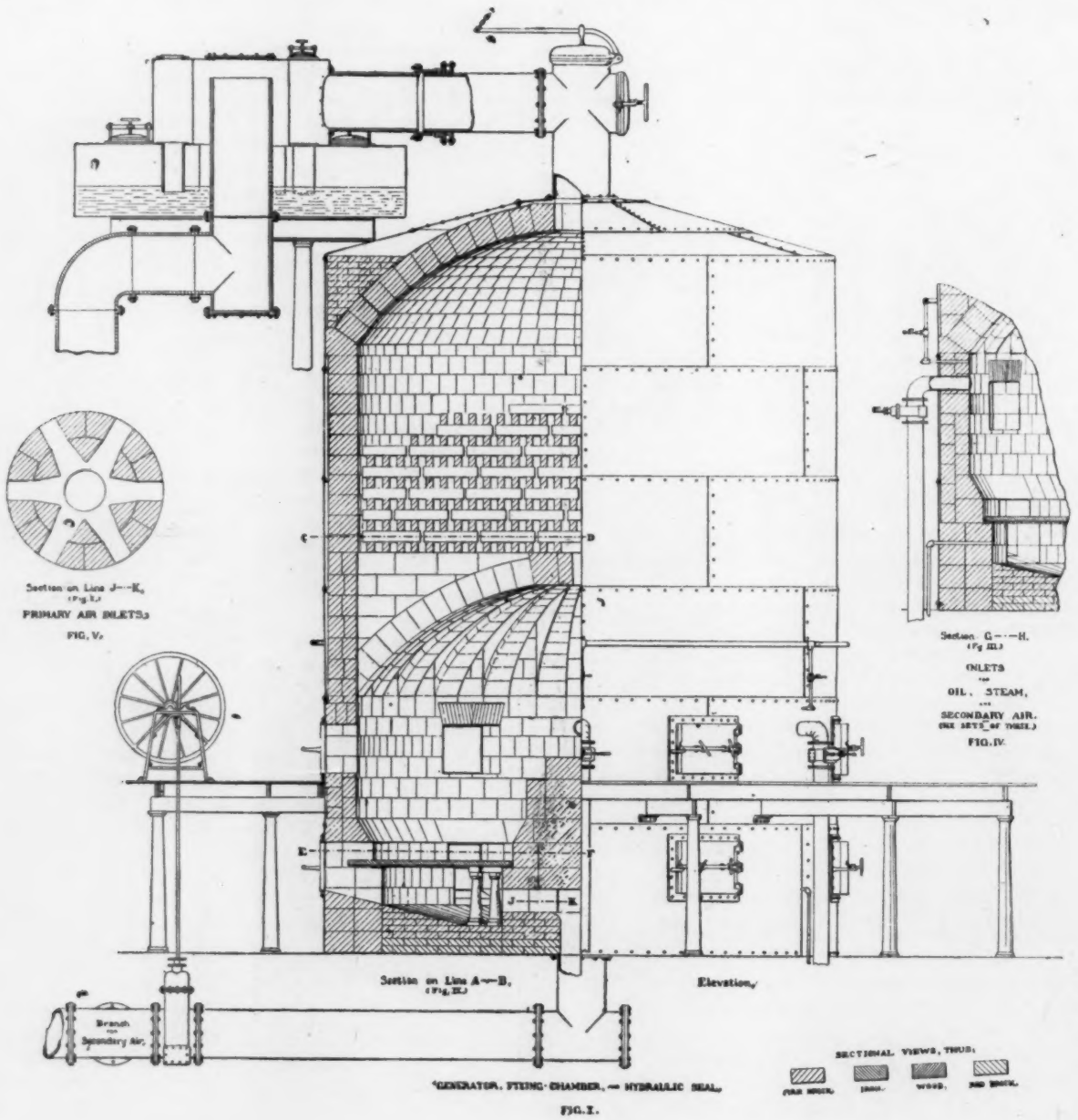
[The illustrations, drawn from the original sketches, by Mr. Geo. T. Thompson (St. Louis, Mo., Feb., 1889), were prepared to show a working plan. This idea, however, was not adhered to in preparing the engravings for the Journal. The cuts nevertheless give a clear illustration of a typical cupola water gas apparatus—capacity 1½ million cubic feet per diem—designed and operated at Chicago, Ills., 1883, by Mr. Frederic Egner, Engineer.—Ed.]

In these days of many inventions of theoretical methods and apparatus for the manufacture of illuminating gas, the description of one which has been successfully operated from the first, and which stood the test of several years' continuous working, may interest the readers of the Journal. It is not pretended that the apparatus herewith described was faultless, and some of the mistakes in construction as demonstrated by subsequent practice are pointed out in this article; but the net results obtained with this little giant—for it was no less—will be given later on, when the thoughtful reader will be able to make comparisons with other and more modern machines. The facts related are from personal experience; and in giving them for the entertainment—and it is hoped pleasure—of our fellow-craftsmen, from many of whom we have received in time past similar benefits, it is only regretted that want of time prevents the author from giving his views of the details which are required in a perfect gas producing apparatus. But as facts, not theories, are perhaps most desired just now, we will proceed with our description.

In the spring of 1883 the writer was called to Chicago by the President of the Peoples Gas Light and Coke Company, and during his stay at that city designed and superintended the erection and first operation of a water gas apparatus, of the kind which is now so well known as the "Springer-Cupola," and which was then the first, and probably is still the largest, apparatus of that class that was ever built.

Springer was the first to place the fixing chamber into the same shell and over the generator of a water gas apparatus (for which he was granted a patent Jan. 31, 1882), but beyond that, it is only fair to state, he had nothing whatever to do with the planning and operating of the apparatus which is the subject of this article.

The Springer cupola as shown in the patent mentioned is quite different as to internal arrangements and operation, and was never successful

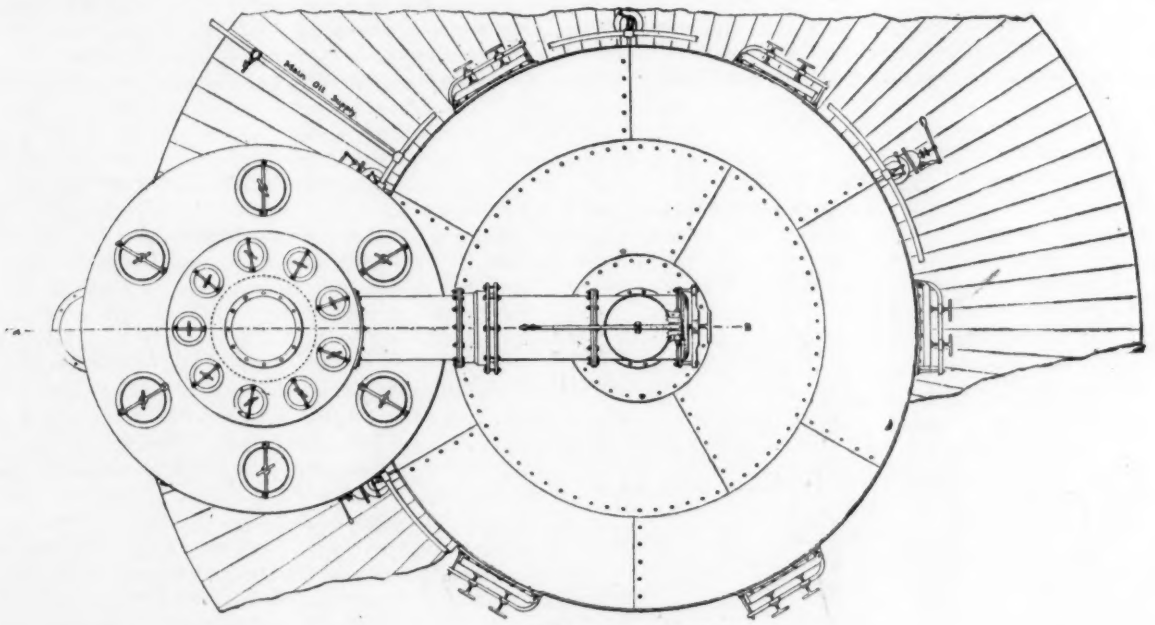


in the original form. Afterward all Springer cupolas were constructed in the main to conform to the plan of the one herewith illustrated. It was still further improved, and is now the simplest of all the many styles of water gas producers; and, when properly handled, is as effective as the best of them as to results, except only, perhaps, the Flannery process.

The conditions given to be observed by the Engineer in the construction of this apparatus were: To practice close economy in the expenditure of money; produce a good machine; and do it in a very short time. Briefly stated, these conditions were all fulfilled as follows:

Within two months after spreading the first sheet of paper for the drawings to be used in the construction of the apparatus the same was in operation, making gas at the rate of 1,300,000 to 1,500,000 cubic feet per diem; and the cost of the cupola, hydraulic seal or wash box, and

all pipe connections, firebrick, and labor was less than $10,000. All the designs and drawings used were made by the Engineer, except those for the hydraulic seal or wash box. In that he was assisted by Mr. Cowdery (now of Milwaukee), who made the working drawings of that part of the apparatus, after the Engineer had invented and sketched the original for him. In order to be economical all the old material on hand or that was at all serviceable was used, and it comprised chiefly material left over from previous experiments made by predecessors.



PLAN OF CUPOLA — HYDRAULIC SEAL.

FIG. II.

This material consisted of a number of cast iron frames, doors, and cotter bars, much too large for good work, and a huge boiler-iron shell, which, although not in the proportion desired, still was too costly to throw away; hence it was altered to conform to the new plans, and put to use.

The illustrations given are from drawings recently made by Mr. Geo. Thompson, who deserves credit for having represented the apparatus very near like what it was. The general dimensions are correct, as these were obtained from rough sketches taken from my scrap books (assisted by memory), after which the original drawings were made—which latter were all left at the works in Chicago. The illustrations herewith submitted, seem hardly to need any further explanation, but a few general remarks on the whole may be of interest and service.

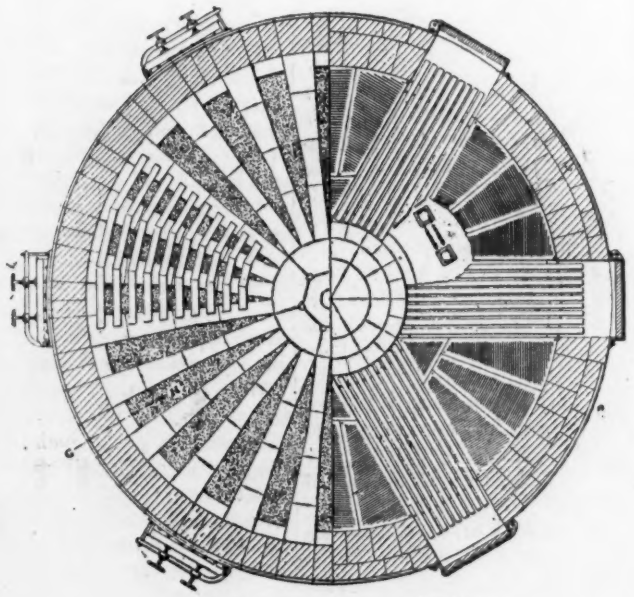
The center column in the generator chamber was used to reduce the fuel space and bring it into better proportion with the space that could be spared for fixing chamber purposes, without resorting to cutting away and raising the dome of the shell. By carefully arranging the checker-brick tiles the relation of grate to heating surface was brought to be as 1 to 95—which is scarcely enough, even when using ordinary 63° gas naphtha, while with crude petroleum or other heavier oil the proportion given would be entirely insufficient in the cupola style of water gas apparatus.

Instead of ordinary firebrick, fireclay tiles were used for the checker work. These are only partly shown in Figs. 2 and 3, for obvious reasons.

The oil was injected by means of a force pump through three nozzles (although six had been provided), shaped at the ends like an ordinary lava-tip gas burner. In that way a thin sheet of oil was spread over the whole fire surface while gas was being made.

As much depends in any water gas apparatus on the intelligence and judgment of the person in charge, who is sometimes called the "gas maker," so in this one the best results obtained by far were those when Mr. Geo. H. Brown (formerly with A. O. Granger & Co., of Philadelphia), was in charge.

The fire grate of the apparatus was composed of 24 fixed cast iron sections, supported as shown, and 6 sections of 2-inch square wrought iron movable bars. The primary air pipe was found to be larger than needed by 50 per cent., and the secondary air pipes (six 5-inch pipes) could have been 25 per cent. less in area.



SECTIONS OF GENERATOR.

FIG. III.

The method of moving the heavy outlet valve on top of the generator was quite ingenious, but could not easily be shown in the drawings. That was the device of the Mr. Brown who is mentioned above. The arrangement for moving the large primary air valve, invented by the Engineer, was afterward copied by the Chapman Valve Company, and can now be had ready made. A safety valve for the air-blast pipe, which is not shown, was placed behind the principal air valve, to prevent accidents to the blowers. This was the device of the President of the Company, who seemed to be pleased with the whole apparatus, if report (not the author's experience) speaks true.

This apparatus was used for a number of years, and at last accounts was still standing, although in need of a few repairs.

When running steadily, 1,300,000 cubic feet of gas could be easily made per diem with the aid of one steam engineer, one gas maker, and two ordinary laborers on watch, for each 12 hours. Three men in the purifying house, one night watchman, and one clerk completed the *necessary* outfit of the works. By using a little more oil and coal the capacity of the apparatus could be greatly increased. The room taken up by the latter was a space 36 feet square.

The average results for a year figured up about 4½ galls. of oil, 48 lbs. of coal (including that for the boilers) to produce 1,000 cubic feet of 18 to 20-candle gas.

While the true criterion of the value of any method of manufacturing illuminating gas is undoubtedly the cost of the article of a stated candle power in the holder—and the items which go to make up this sum include first cost of plant, liability to and cost of repairs, and cost of material and labor—these items vary so much and are affected so greatly by local conditions, that the gas engineer, in order to arrive at a just conclusion as to the excellence of any apparatus, can only consider the first cost and liability of repairs of a plant and amount of material and labor required to produce a stated quantity of a certain kind or quality of gas. Naturally, it would appear that the simplest apparatus should be the cheapest, and, if the results were alike, the best and only apparatus to buy; but just here it is where the would-be purchaser is most likely to be deceived.

If we could only induce the makers and venders of the various gas apparatus to submit to an impartial *competitive examination*, it would soon settle the matter and be far better for the large majority of gas companies. But no single company could or would undertake such an examination, and then make public the results of their investigation. And possibly very few of the patent gas process venders would be willing to submit their claims to a thorough practical and impartial investigation, however honest they may be in all they do or say.

[Concluding Article.]

Notes and Comments.

By OBSERVER.

I have always had the impression that a critic who sought to review remarks published in due form in a journal that had a local habitation and a well-known name, should carry on the argument in the pages of the journal which originally contained the matter that spurred him on to state his objections. Perhaps I am mistaken in that idea; but courtesy, however, would seem to be served by such a view. In any event, I note that a paper published in Philadelphia, and dated February 28, printed a correspondence signed "Experience," in which the latter asks me a few questions, in "good Yankee fashion," as he puts it; and with evident good feeling, I might add. As I had originally chosen the field for ventilating my opinions, I will try to answer "Experience" in the field so selected.

First.—"Experience" asks: "If he [Observer] were interested in a gas company which had for several years furnished electric light as a part of its business, and that, not only keeping the plant in perfect repair, but charging up 6 per cent. for the depreciation and 6 per cent. for interest, it had paid from 5 to 6 per cent. annually, and that during this time the gas plant had been improved and kept up—the increase in sales having averaged as high as ever before—under these conditions, would he say that his Directors acted unwisely, and that it would have been better to let some one else have this money, and taken more of the time of his officers to fight competition, at the expense of proper care of his plant?"

I would *not* say they acted unwisely.

Second.—"Does Observer know of any gas company in a small place that, after keeping up repairs, sets aside 6 per cent. for depreciation and then pays from 11 to 12 per cent. dividend?"

I think I know of some that are earning as much as this on the cost of the gas plant.

Third.—"Why is it that almost every day we read of gas companies asking for charters allowing them to 'enter the field?'"

Because they think it best to "control the situation," protect their interests, and realize a profit on the undertaking, if possible.

Fourth.—"Each year the manufacturers are compelled to enlarge their facilities to keep up with the demand—the sales last year being reported almost double those of the preceding year—nearly every plant in operation (furnishing light) being forced to enlarge to keep up with the demand. Would this be possible if the business were as disastrous as indicated by Observer?"

It might be.

Fifth.—"Finally, has Observer ever heard of a gas company that has made the venture regret this action?"

I have.

Lest my friend, "Experience," should take the brevity of these answers as an indication of discourtesy, I will add a few words. In speaking as I have on the subject of electric lighting by gas companies, I have nowhere said that no gas company is making any money on the project; but I have said that "Some appear fairly well satisfied with it."* If "Experience" will read all I have said he will come to the conclusion that I have not taken any isolated cases on either side, but have heaped the subject *as a whole*. Had I been inclined to quote isolated cases I might have referred to a gas company (in which the writer is interested) that put in an electric lighting plant last year, and which has not yet paid a dividend; and, further, that our Secretary writes me that our usual gas dividend now due will have to be passed this time owing to having put in the electric light plant. A year ago he was very enthusiastic on the subject of electric lighting. I do not know how he feels now. But we hope for the best, of course, and if we should realize anything like what "Experience" has done on his plant, I for one shall be delighted. So far, however, our hen has not laid twice a day—nor even once.

As to the rapid growth of the industry, I think this is easily explained. The light is comparatively new, the people want it; and at present are willing to pay more for it than gas. Go back, say, 10 years. There was not then an electric light plant in the country, wherefore, of course, the electric light plant manufacturers have been and are kept busy supplying wares not only to corporations, but to private parties also. Suppose 10 years ago there had not been a gas plant in existence, and that the demand for gas prevailed—I surmise that gas works builders would have been kept more than busy.

With regard to any gas company having regretted its action, I think I know several such cases. One gas man known to me says his company made a mistake—he is a thoughtful, deliberate man, and does not speak unadvisedly. Another, when I asked him if he was making any money, answered, "No; we have to count on the old reliable for our dividends." And still another case where the gas company bought an interest in the electric light plant, and after operating it a while, shut it down, *because it did not pay.*

"Experience" speaks of some gas plants having been sold, and says he has known of several being sold for much less than their cost within a few years. I myself have known of some gas plants, built on a fictitious basis, that have been sold; but not for *less than cost.* They may have been sold for less than their capital stock, and undoubtedly were; but cost is one thing and capital account very often another. I have several cases in mind where *the bonds built the works*, but a good, big jag of stock was issued and sold to the unsuspecting, at "ground floor prices;" the builder has left for greener pastures, the interest on the bonds is not paid, and then the holder of said bonds takes the works, runs them and makes money. Shall we say the gas company was responsible for this state of things? or was it the manner in which its financial birth was assisted? Before leaving this subject I wish to congratulate "Experience" on the happy condition of things with which he is surrounded, and hope it will continue.

I sometimes think there is no other business in existence that the public know so little about as the gas business. To see how much (or rather how little) they know as to the *value* of gas, for instance, let us ask what gas is worth, and not one in ten can answer correctly. They know what drygoods, groceries, lumber or bricks are worth, but as to the value of gas they are ignorant. They look upon the gas business a good deal as they would look upon a gold mine. I have frequently heard it said, "Why, you cannot buy any gas stock in our town; it is not for sale;" intimating that it is a sort of bonanza, else it would be on the market. The fact that gas stock is not usually listed on the stock exchanges, as are railroad and mining stocks, for instance, hence is not usually subjected to the speculative whims and caprices of an open money market, but is held pretty much as a man in business holds his interests, does not occur to them. Without discussing the causes of this lack of information on the part of the public, can we wonder that people are easily induced to invest their money in gas enterprises, only in some cases to become the dupes of those who are too sharp to be honest, and, being so, are a disgrace to the profession.

Permit me to instance such a case that recently came under my notice. A gas works poorly constructed, with mains and services altogether inadequate, with less than 100 consumers, loaded down with $50,000 of stock and half as many bonds; of course it has never paid, and never will under its present organization. The end of it will probably be that the bondholders will take the works and make the best of them; but where will the stockholders be? Why, left, of course. Those were the *lambs* whom the "engineer" took in, and then left for some other part of the country where he had "a call" to build a plant, to repeat the operation there, probably, if opportunity offered.

Leaving this part of the subject for the present, let us turn our attention to the question of a monopoly of the gas business. The business of the manufacture and distribution of gas differs very materially from most other kinds of business. If a concern engaged in the manufacture of wagons or reapers or sewing machines is not satisfied with the returns on the capital invested, or if better facilities are offered at some

*See JOURNAL, Jan. 21, p. 74.

other point, it will probably remove to the latter; the old factory can be sold, and a new one, with all modern improvements, take its place, which tends to show that the removal is attended with positive benefit. Not so with a gas plant. Who ever heard of a gasholder or a retort stack or street mains being removed? That which a gas company owns is valuable where it is, and would have but slight or no value anywhere else.

During the past 10 years we have seen the results of competition in the gas business. In many of our large cities opposition works have been built. The story is so familiar to us all that it would be like "threshing out old straw" to go into it, so we pass it by with the remark (based on past experiences) that, ultimately and permanently, cheap gas is an impossibility where two or more companies furnish it in the same field. It is the sheerest nonsense to promise such a thing. How can it be otherwise? Take, for instance, two or three companies, with mains running side by side, with services running side by side, and with meters resting side by side—each company with a plant of its own, with an office of its own, and with officers of its own, from the president down to the lowest canvasser that solicits the patronage of the lowest groggery. Do not talk to me of the benefits of competition in the gas business. It has no permanent benefit, either for the consumer or invested capital. Now, after having taken this ground, the question naturally arises, "Ought we not be willing to have our capital stock and our dividends fixed by law?" Certainly we ought. The same power that clothes us with all the privileges incident to entire control of the business has the right to control our actions. Now, I am aware that this idea is not popular with us; it seems too much like an interference with our personal liberties. I admit it does look a little that way; but does it not at the same time curtail very materially the personal liberties of those who pose as public benefactors—deliverers of an oppressed people from the rapacity of a gas monopoly—also, of those who build gas works with other people's money, and all others of kindred type? I think it does.

I claim that it *protects* the consumer and the investor alike, thus affording the greatest good to the largest number and proving itself to be the greatest blessing. We have no moral right to water our stock and then pay large dividends on it.

I have in mind two gas companies—doubtless there are others, too—that have conducted their business on what might justly be termed model principles, both of which have hit the dollar mark.

To what source shall we look for legislative control? I must commit the answer to an abler pen than mine. But it must be to a higher power than the (very) Common Council. I think we could learn some things from our trans-Atlantic friends in this regard. They have had much experience, and could probably give us some points. Whatever is done should be with a view to the future, and for the general welfare. There is too much money invested in the gas business, too great interests are at stake, and too great a future is before it, to have it lightly legislated upon.

Many years ago I remember that an enthusiastic stockholder (a retired sea captain), as we were seated at the festive board (not the Board of Directors), proposed to organize a company for the purpose of lighting up the Gulf Stream. I have never heard that the project was carried out—some delay, probably. A grateful public may not even put in the foundation stones that the "Hero of Fort Hill" has spoken of this year, but the predictions of the "Hermit of Westminster" have been realized, and I expect to see the day when all will unite and proclaim that in the realm of artificial lighting "Gas is King!"

(Continued from page 239.)

Gas Making in England Forty Years Ago.

By GEO. ANDERSON, C.E.

[The fourth of a series of articles in course of publication in the *Gas Engineers' Magazine*.]

Early in the autum of 1856 when we had half the streets of Cork torn up by Mr. John Aird, our main and service laying contractor, it had permeated the mind of the English company that we were really going on. They issued a notice of a reduction in the price of gas to 4s. 6d. per 1,000 cubic feet, from September next. I wrote an article for the *Cork Examiner*, entitled 'The beginning of the end,' animadverting on this fall from 6s. 8d. before "your own company" took the field to 2s. 6d., which could only be to beat "you" out of the field, when they could again raise the price.

The effect was that we began with several hundred more consumers than we expected, although several large consumers had contracted to take the old companies' gas for three years at 2s. 6d. per 1,000 cubic feet. We had the works finished and gas supplied to the city several days before the time stipulated in our contracts with the consumers, and the supply was not attended with any of those contretemps which characterized the day and night hurry at the Great Central. I had Mr. Robert Morton, late of Vauxhall, as my clerk of works within the gates, and Mr. Johnstone, late of the Equitable Company, and Mr. Still, late of Chartered Company, both of London, as inspectors in main and service laying and fixing meters. Mr. Morton managed the works for some weeks after the start, when Mr. Still was appointed manager, a position he had held for many years in London, and as one instance of the stability of some things in Ireland, Mr. Still is still a respected officer of the company at Cork. Our success being greater than we had expected, we thought next year of enlarging the works. Our first dividend was one of 5 per cent. with every liklihood of it increasing so our shares were rising above par.

There was one ugly thing, however, the look of which I did not like. Our consumers were paying 4s. 6d. while an old company's consumer, it might be next door, was only paying 2s. 6d. Query, how long could this last? The old company had five times their Cork business in other places, Dublin, Limerick, etc.—might they not fight Cork with ammunition from other citadels? So, in the early spring of next year, when our Board met to consider an extension of our works, I proposed that we should try and buy out the old company. Our directors were no way averse to this, but they were proud—high minded. We had offered, before we laid a pipe, to purchase them at £40,000, the amount of my estimate to build new modern works. The old company asked £60,000. When we were well advanced with our works we offered to buy their lamp-posts, for we had obtained the contract for public lighting. The answer was, they would treat with us when we were in a position to supply. Thus we erected our lamp-post "cheek by jowl" with theirs and gave a light double the size of their's, which told well in the public mind as to the very superior character of the new company's gas. Thus we had been treated in a manner that forbade any of our directors approaching them.

"May I do it in London, where the head office of the company is?" This was agreed to. I wrote to the secretary asking could I see the Board relative to the purchase of their Cork works. An answer came—yes—naming a day. I waited on them, and without any diplomatic nonsense told them that our Board had to consider an extension of our works; that I thought it a pity to do this and much better if we bought their works; that now we could offer a fair price, but if we extended our works, of course then we couldn't. The directors of the old company met me as business men; we began to speak of terms. I asked—"What is your annual consumption?" They replied 50 million cubic feet. I offered £25,000 on a 50 million basis, but if it should be more then I was to give more in proportion, and proportionately less if the consumption be less. This was agreed to and the business was settled under an hour. The result was that they proved a consumption considerably over 50 millions, and we paid them about £26,500, and so ended the competition.

That same year I heard that the City of Waterford Gas Company was in a bad way. This was an Irish seaport with about 25,000 inhabitants and a gas consumption of only 12 million feet. The company had had no dividend for 10 years—several suburbs had no mains—the Corporation were gradually throttling them. They offered the works, which had cost some £20,000, at £10,000, while the Corporation offered only £8,000. At this juncture I visited Waterford, saw I could make a good thing out of it, agreed to give the £10,000 they asked, and the bargain was closed. I formed a limited company, agreeing to engineer the reconstruction of the works and sell the works and my services for £12,000. This was agreed to with a condition that I should work the concern on a lease at such a price as would guarantee a minimum dividend of 5 per cent., and pledge my holding in the company about £2,000 as security. On this basis we obtained all the capital we wanted.

The corporation who had been cajoling the company would not believe that any sale had taken place, but that I was a bogus man set up by the company to defend them. They could not believe that the pear which they had seen ripening on the tree had been plucked perfectly sweet, and by a stranger; consequently I had everyone against me. I announced to the citizens that I would modernize the works; that I would lay mains in the unlit portions of the city; and I asked an interview with the corporation to know what street lamps they would require. To pay my respects to them we met, but we did not do any business, although I offered to extend the mains wherever they wanted lights in the streets; and the want of these was one of their grievances against the old company. They still thought, I suppose, that I was the old company's bogus man.

I again got Mr. John Aird to enlarge, overhaul, and extend the mains into the districts complained of, telling the citizens that for street lights they must go to the Corporation. For private lighting I would supply them. Thus we got many consumers, and the citizens fought our battle with the Corporation, about the street lights, which were also got the same year. When we had practically completed the extension of the mains, the Corporation discovered that we had no power to open streets save through leave of them, and ordered us to stop which we did, and applied next Session for Parliamentary power, which we obtained in face of their opposition. The consumption has now increased to three times what it was, and without any increase of population. The shares in my new company were wholly taken by my personal acquaintances in England and Ireland, and they have had their 10 per cent. now for many years; and I still work the concern for the company, now going on for 30 years. Simultaneously with carrying on the Dover and Waterford gas works, I gradually included others, viz., Fermoy, Mallow, Carrick, Kilkenny, besides acting as engineer for several others both in England and Ireland.

During the same period Mr. Stephenson Clarke and I joined in the purchase of a gas works in the Island of Corsica, France, which we worked for 10 years without reaping any profit through bad managers—consisting of fools, rogues, and knaves. Then I sent my second son to manage, since which we have had a fair return. During these years I have taken six patents—four in gas apparatus—all of which have been remunerative, and two outside the profession which have not yielded anything. The first of these was for the ventilation of sewers and purifying the gases they contained. This was before the London main drainage was carried out. The second was for the cultivation of oysters, which I let drop, being so much otherwise engaged.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

It is reported that the Grand Rapids (Mich.) City Council has granted an ordinance for the operation of a fuel gas plant in that place. Its projectors propose to work under the practice followed at Jackson, Mich. The life of the franchise is put at 30 years, and the promoters have capitalized the enterprise in the sum of $30,000.

The Brooklyn (N. Y.) political electric light combine has been granted another year for plunder. Chairman Wafer, of the aldermanic lighting committee, reported that the lighting contracts for the ensuing year should be made with following companies, at the prices noted—an all night and every night schedule to prevail:

Name of Company.	Contract Rate, per Light.
Citizens Gas	$22.00
Nassau Gas	22.00
Peoples Gas	22.00
Metropolitan Gas	22.00
Williamsburgh Gas	21.70
Brooklyn Gas	19.80
Citizens Electric	182.50
Municipal Electric	182.50

The electric lights (about 1,350 are in use) are nominally rated at 1,200-candle power each, but practically they do not exceed 500 candles. The gas companies were this year asked to submit proposals on the basis of a 4-foot supply per hour, instead of the former 3 foot plan, but the committee rejected the innovation when it was found that the better service would entail an average increase in cost per lamp per annum of $6. The findings of the committee have been ratified by the Board; although before the motion for adoption was voted on one member proposed an amendment, cutting down the award for arc lighting service to $125 per lamp. The mover's vote was the only one cast in favor of the reduction. From this it will be seen that the Shevlin-Delmar-Barret-Cooper combination is to remain in control of the Brooklyn situation for another twelvemonth, at least. In the meantime the murmurings of the taxpayers seem to take on added volume, and many shrewd observers predict that the next mayoralty election will witness the complete rout of the present reigning powers. In viewing this likelihood isolated holders of shares in the "protected" electric lighting companies might do well were they to accept market rates for these shares. The day for piercing this huge and uncanny Brooklyn bubble is fast approaching.

Messrs. Jno. A. Hambleton & Co., of Baltimore, Md., are offering to investors an issue of $250,000 first mortgage 6 per cent. bonds, the security offered being the plant and franchises of the Montgomery (Ala.) Light Company. The bonds are to live 20 years, and are offered at 97½ and interest; the income to be paid in New York city in January and July of each year. We agree with the Messrs. Hambleton in thinking that these bonds offer an excellent opportunity to investors, and our presentation of the fact to our readers is made from no pecuniary motive—not even in the shape of a paid advertisement. The old Montgomery Gas Light Company was chartered in 1852, at which time it was given an exclusive privilege to supply gas in that city for a term of 50 years. Not long since it obtained the right to amend its charter and alter its corporate name, the object being to acquire and operate the franchise and business of the local Brush Electric Light and Power Company, which Company had a valuable contract from the city, besides a fairly good commercial trade. The mortgage issue is a first and only lien on the consolidated venture.

It may be taken for granted that the lighting controversy at Lockport, N. Y., has been practically settled for a term of two years, the Council having made a contract with the Lockport Gas Company to cover that period. The prices agreed on are: Each gas lamp per annum, $15; each 20-candle power incandescent electric lamp, $14; each arc (2,000-candle) $80. A moon-table schedule is to be followed.

Director Wagner has an ambition to accomplish the removal of the gas works station at 23d and Market streets, Phila. It would be a good thing for the city, and not a bad one for the gas system there, either.

From and after to-day the gas rate in Crystal Palace (London) District Gas Company's territory is to rule at 65 cents per 1,000 cubic feet. From the half-yearly report to the shareholders (a copy of which was kindly forwarded to us by Secretary Ohren), covering the Company's operations for the six months ended December 31, 1888, we note that the increase in quantity of gas sold over the corresponding period of 1887 was almost 4 per cent.—357 millions having been accounted for. Of this amount the different allotments were:

Meter Accounts.	Public Lamps.	Used on Works, etc.
331,446,600 cu. ft.	23,567,200 cu. ft.	4,096,200 cu. ft.

The unaccounted-for gas is returned at 6.1 per cent. Coke sales receipts averaged much better than those of a year ago, as was the case with other residuals, and coal was obtained at a cheaper figure. Under these pleasing circumstances it is hardly necessary to add that the maximum dividend rates were declared. Surely, time does not detract from Mr. Ohren's ability as a gas works manager.

The Spencer (Mass.) Gas Company takes its water supply from the town, and had stoutly contended that the quantity used was of insignificant value. When it came to payment for same the Company and the Trustees differed widely in their estimates of what the bill should be, so a water meter was installed with the result that the Gas Company's bill will hereafter be something like $375 per annum.

The Committee on Manufactures of the Massachusetts Legislature is considering the resolution of Representative Mellen (Worcester) which proposes to vest the cities and towns of that State with the right to embark in the business of gas making, and to acquire the plants of existing gas companies. This resolution has attracted widespread attention, and has impelled the interest attacked to form itself into organization for resistance. Several hearings have been held, and while we do not think the Mellen measure stands much chance for adoption, it is nevertheless amusing to note the reasons put forward by the author for the success of his legislative bantling. In his opening argument before the Committee Mellen plaintively admitted that his position was lamentably weak, in that the public did not seem to appreciate the gravity of the situation; for while a search through the State Library failed to reveal anything written "on the side of the people," as he put it, the other side—meaning the "wicked gas companies," of course—was so represented. He explained this paucity of literature on the subject on the ground that the "gas business was so new," which would be understandable did he add "new to him." We do not know how many years have been recorded on the Mellen personal calendar, and do not care particularly; but we are quite sure, whatever his age is, that he is much "newer" than the business about which he speaks. Turning lightly from this he then dips into the evils of stock watering and duplication of capital, seemingly oblivious to the fact that the Councilmanic cormorants of the past are solely chargeable with the creation of the latter evil. Take, for instance, the proposed action in respect to the gas supply of the Chelsea district. Certain capitalists are anxious to duplicate (we believe, however, they would much rather buy out the old Company) gas capital there, and for that purpose applied to the Council for a franchise, which was granted in the most off-hand manner possible—not a chance for a protest being

allowed—only to be recalled later on when it was found that the franchise so obtained was valueless, through gross ignorance on the part of the Council as to what it might or might not do legally. Undoubtedly stock has been watered—and the Chelsea case furnishes an instance where the irrigating pot might be called into play—and capital has been duplicated, but such results can, in nine cases out of ten, be traced back to the municipal authority—the very power that Mr. Mellen would now seek to place in control of vast vested interests. Can Mr. Mellen give an instance where the records of the past respecting municipal control of gas works tell the story of an advantage to the people in such ownership? Take the well-known examples of Philadelphia, Pa., and Richmond, Va. These cities have controlled their gas supply for many years. What is the result? The private consumer in each of them pays more for his gas than does his prototype in Boston proper, where the manufacture and supply of gas have always been under private control. And what is the reason? The two first-named properties have been subjected to the whims and peculations of politicians, whereas the last-named has had the benefit of trained minds, whose efforts were directed to the conservation and improvement of the interests committed to their charge. No one claims that philanthropy was the moving cause; good business practice wherefrom to reap profit was the incentive. Mr. Mellen also took occasion to show his contempt for constituted authority by remarking that he "would not give a penny for the Gas Commissioners, as they were merely creatures of the Boston Companies." But his wilful slurring of three independent, clever, intelligent and upright citizens of a State, a district of which he unfortunately misrepresents in the Legislature, is of a piece with himself and his argument. Might we ask him was it the Boston Companies that caused the Commissioners to institute the Worcester gas investigation in the spring of 1887? And are we to give credit for the good results which accrued to Worcester's gas consumers, and to the Worcester Gas Company also from that investigation, to Mr. Greenough, Mr. Addicks, or any others of those connected with the Boston Companies? It has been said that beggars, when mounted, are not over nice in selecting the destination towards which they ride, and their indiscrimination in this respect is not a whit behind that of the average legislator, who can be always counted on to grow warmly indignant when discussing a question about which he knows nothing. And his agenda list carries a very large quota of such questions.

THE Pawtucket (R. I.) Council is still wrestling with the public lighting contract, the last contest that we are cognizant of being over the latest proposition submitted by the Pawtucket Gas Company for electric street lights. The Company offered the following: For a 3-year contract—50 full arcs on all night circuit, $140 each; 100 half-arcs, on midnight circuit, $80. For a 5-year contract—50 full arcs, on all night circuit, $120; 100 divided arcs, on midnight circuit, $80. Lights to burn for 360 nights each year, and additional ones to be paid for at same relative price. The discussion that ensued was of the quality that is generally reported on such occasions, although three of the Fathers intimated that they favored giving the Pawtucket Gas Company more money for the service than they would care to award "outside companies." Some others of the Council were in doubt about the power of the Council to enter into a contract for a term of years, whereupon the matter was postponed for a week; a further understanding being that the City Solicitor should render an opinion on the right of the Council to make a long-term contract.

THE North Brookfield (Mass.) proposed gas company project still hangs fire, although those behind it say they are willing to put in $25,000 in a works, and having operated the same for five years, will then allow the town to take the plant at a valuation.

CHARLES BUCKINGHAM MERRIMAN, who for many terms acted as President of the Waterbury (Conn.) Gas Light Company, died at his home in Waterbury on the 15th inst. He was in the 80th year of his age, and had been a prominent merchant of Waterbury for over half a century.

THE projectors of the Williamstown (Mass.) Gas Company have perfected the following organization: President, O. P. Clarke; Treasurer, J. D. Hardy. The Company is capitalized in $20,000, and it is proposed to begin work in a fortnight.

A MOVEMENT is going on in Philadelphia for a special rate from the city for gas consumed in the hospitals of that city. The concession asked is a rebate of 15 per cent. from the ordinary charge per 1,000 cubic feet.

THE only offer received by the city of St. Louis on its proposition to purchase or lease the local gas plants was handed in by the Laclede Company, which offered to lease its works for a term of 30 years at an annual rental of 6 per cent. on a valuation of $3,650,000.

ANOTHER bill recently presented in the New Jersey Legislature authorizes gas companies "to locate and lay conductors through streets of any city, township, borough or village, and furnish the same with gas."

IT appears that the legislative measure in New Jersey providing for the appointment of gas inspectors for Newark and Jersey City will not become a law. Mr. O'Neill, who proposed the bill, made "a few violent remarks" in favor of the scheme when it was brought up for vote before the House. He delicately alluded to the gas companies as gas stranglers, but the "stranglers" seem to have had the House with them, for the bill was lost by a vote of 18 to 34.

THE Mutual Gas Light and Fuel Company has been organized in San Francisco, Cal., by Messrs. Columbus Bartlett, Robert Dickson, Jno. T. Kennedy, H. L. Coye and Sampson Tams. Judging from the number of charters of this nature recently taken out for Frisco, the latter ought soon to have fuel gas in one shape or another.

SENOR LUIS GARCIA LUNA, whose address is "Treasurer-General, Oxaca de Juarez," will receive bids for the establishment of a 100-light, full power arc plant, complete. The competition will close on April 12.

THE proprietors of the Middleboro (Mass.) Gas and Electric Light Company have applied to the Selectmen for permission to erect poles and string wires for the purpose of furnishing electric light. It is proposed to install a complete plant for arc and incandescent lighting. The local Thomson-Houston branch does not like this move.

FROM a local source we learn that electric lights were first introduced to Burlington (Vt.) on the occasion of the winter carnival there in 1886, chiefly through the efforts of those who organized the Brush-Swan Electric Light and Power Company. Some time afterwards the Burlington Gas Company offered to purchase a controlling interest in the new venture, and in the spring of 1887 the exchange was completed. In July the new proprietors began to supply the light, but much trouble was experienced in keeping up the power for the station, which was derived from the dam at Winooski bridge. Shortly afterwards it was determined to remove the apparatus to the site of the gas works at Battery and Bank streets, where high or low water levels would count for naught. A substantial brick structure, 35 ft. by 50 ft., was built to house the electric plant. Starting in with a 140-horse power boiler and two 60-horse power engines, running four dynamos, the Company speedily found it necessary to duplicate both boilers and engines, while the number of dynamos has been increased from time to time until the Company now has eight machines. The boilers are set with the Jarvis setting. The furnaces burn a mixture of soft coal and wet coal dust or slack, giving a regular gas flame, and with the air ducts in the side walls which feed heated air over the fire boxes, insuring perfect combustion. The flues to the boilers lead into a substantial chimney, 6 feet square at the base and 75 feet high, built on the so-called Rochester plan, with hollow walls. The boilers, which are supplied with pump and injector, are set in a portion of the old building adjoining the addition. The portion of the basement in this addition which is not taken up with the solid foundations for the engines and dynamos is used for storage purposes. The room above contains the engines and dynamos. This part of the plant consists of four Armington & Sims' 60-horse power engines, seven standard Brush arc dynamos, capacity of 210 high candle lights, and a Westinghouse alternating current dynamo with a capacity of 500 incandescent lights. The engines run at a speed of 280 revolutions per minute, the arc dynamos 950, and the incandescent dynamo 2,000; the well-known Schieren belts are used on all the machines. A complete switchboard, containing the switches, lightning arresters, rheostat, voltmeters, ammeters, compensators, and the other necessary appliances, takes up a portion of one side of the room back of the incandescent dynamo. For the arc light circuits "plug" switches are used, so that any dynamo can be run in any circuit. The building is supplied with a 2 inch water pipe for fire service, with lines of hose on each floor; and is in short a complete electric light station. The Company is now running 162 arc lights of 2,000 candle power, on four circuits. The street lights, of which there are 101 burn from half an hour after sunset until 12:30 o'clock, except during the period of moonlight each month. The commercial light circuit is turned on when it is needed and runs until 11 o'clock. Once a year all the lamps are separated and thoroughly cleaned. The Company has run its incandescent dynamo but a short time, but the light is of good quality. The Company has just wired the buildings known as the Young

Men's Christian Association block, and the new Ethan building. For use in large buildings or houses where intermittent lighting is the rule the Company has a Westinghouse meter for measuring the current. Our correspondent closes by saying that electricity will never supplant gas as an artificial light; but the Burlington Gas Company can be depended on to keep abreast of the times and to furnish its patrons with the best there is going. The officers of the Company are as follows: President, Wm. Wells; Treasurer and Superintendent, F. H. Parker; Directors, W. Wells, U. A. Woodbury, B. B. Smalley, G. L. Linsley, J. S. Pierson, A. G. Pierce and F. H. Parker.

In connection with a prior reference to the passage of an ordinance by the Council of Grand Rapids, Mich., granting the right of way in that city to the organizers of a fuel gas system—similar to that installed at Jackson—we are informed that the Mayor vetoed the Councilmanic action. Our correspondent adds that there is no likelihood of the Council passing the measure over the veto. The price named in the ordinance at which fuel gas was to be sold was 40 cents per 1,000 cubic feet.

A boarding house keeper named Warner has been charged with larceny by the Minneapolis (Minn.) Gas Light Company. Warner wanted gas, but he did not want to pay for it and accordingly bye-passed the meter by means of a bit of rubber tubing.

Mr. John A. C. Stacey died at his residence, in Newport, R. I., on the morning of the 16th inst. He had been a Director in the Newport Gas Light Company, and was very much esteemed in Newport, where he had large real estate interests.

The Directors of the Malden and Melrose (Mass.) Gas Light Company have constituted a committee of (three) trustees to hold a majority of the stock at an upset price of $125 per share. The object of this is to prevent the Bay State Gas Company from securing a controlling interest at a less valuation. The Company will issue $50,000 worth of new stock in May to wipe out their funded debt of like amount.

The Goshen (Ind.) Gas Light Company is called on to defend a suit in the United States Court for the District, in which an injunction and $100,000 damages are asked for by the National Gas Light and Fuel Company, of Chicago. Broadly stated the basis of the complaint is that the water gas apparatus recently installed by the Goshen Company is an infringement of the Springer type of apparatus.

The Passaic (N. J.) Gas Light Company recently placed a $10,000 mortgage on its plant and real estate. The loaner was the estate of H. A. Barry, and the interest rental is 5 per cent. We presume that this loan is put on for the purpose of plant improvement, and it gratifies us to add the charming New Jersey city is branching out in all directions. The growth is of the solid sort, too.

The Wilmington City (Del.) Electric Company, having reached the conclusion that many of its customers were using double the amount of current that their contracts permitted, in order to settle the moot-point ordered a large number of Edison meters, some of which are now being placed, and the intention is to gradually introduce the meas urers on the premises of every consumer. It is said the Company now supplies current (incandescent) to 600 subscribers, who maintain 4,800 lights. The arc business comprises 65 commercial lamps and 35 lamps on city circuit.

Gas is now being used in the new jail building at Camden, N. J., to do all the cooking of the establishment.

We understand that the La Crosse (Wis.) gas plant and the Brush electric light plant of the same city have changed hands. An eastern syndicate secured the properties.

Mr. Hiram Blaisdell, President of the new gas company for Cartersville, Ga., who has been on a visit East, says that the Company will be ready to light the streets by April 15th.

The capital stock of the Toledo (Ohio) Electric Light Company will be increased to $200,000, an addition of 33 per cent.

The authorities of St. Joseph (Mo.) are in the market for a municipal plant, arc type. The specifications call for a plant equal to the maintenance of 200 single arcs, with a provision for 10 towers (4 arcs in each) for the suburban districts.

One often hears it said that the gas coal companies earn and pay enormously high dividends. The fact of the matter, however, is that at present prices the "coal barons" have anything but a bonanza. For instance, the Penn Gas Coal Company has just declared a dividend at the rate of 1¼ per cent. for the quarter. And this has been the rate (6 per cent. per annum) for some time.

The Schuyler Electric Light Company, having determined to light Millersburg, Ohio, selected a plot of ground whereon to locate its buildings. The site chosen was close to the residence of a Mr. Stillwell, who objected to the scheme, and brought suit for an injunction. He urged that the jarring or vibration caused by the operation of such a plant would render his building untenantable. Judge Dowell took a similar view, and gave a decision in Stillwell's favor. This is the third case (all in different States) in which electric light companies have been so enjoined.

A bill recently introduced in the New York Senate by Senator Grady provides that electric light franchises for cities in this State shall hereafter be let to the highest bidder. In effect, the Grady measure applies the provisions of what is known as the Cantor Act to electrical companies.

We are glad to be able to say that Mr. A. A. Smalley, President of the Citizens Gas Light Company, of Newark, N. J., has recovered from his recent severe indisposition.

The village of Oneonta (N. Y.) has entered into a contract for the maintenance of 31 arc lights of 2,000-candle power, the rate agreed upon being 35 cents per night per arc. The lights are to burn every night in the year, and the contract is to run for a year.

Prof. Ely, of Baltimore's famous University, is constantly hearing from that catchy but inaccurate lecture of his in Boston. About the best newspaper comment that we have so far encountered in respect to it was in the columns of the Philadelphia *Ledger*. Among other "glittering generalities," put forth by the Professor, was his round charge that gas was being sold in Philadelphia at 37 cents per thousand cubic feet. As it is reasonable to presume that the *Ledger* is fairly conversant with what is going on in the Quaker City, we respectfully call the Professor's attention to what the *Ledger* has to say about 37-cent gas. Our authority goes on to say: "A careless remark by a lecturer in Boston—that 'gas can be made and sold at 37 cents per thousand; I say it can be done, for it is done in the city of Philadelphia, parties supplying the city at that rate'—has traveled about the country and caused much dissatisfaction in other cities. The lecturer neglected to say that this was the cost of gas in the holder to the city, whereas most readers infer that 37 cents per thousand is the charge to consumers. We have not got down to that price here, nor are we likely to do so, even though gas should be manufactured without cost, a large part of the cost of gas at the burner arising from its distribution, office and general expenses. Nor is 37 cents a remarkably low price for gas in the holder. Inventors of water gas processes usually claim that it can be put in the holder for about half that cost, and some gas men say that even coal gas, made by the new regenerative processes (*sic*) for reducing labor can be put into the holder for 37 cents, or less. But the facts are hard to obtain, as gas engineers for private corporations are not disposed to make their business public, and *municipal corporations have no incentive to practice rigid economy, and little opportunity to be enterprising in the adoption of improved processes.*" The italics are ours, and the hard facts conveyed by the words might, perhaps, be worthy the attention of Representative Mellen, of Worcester, Mass.

The American Electric Illuminating Company, to operate in Hempstead, Queen's county, N. Y., has been incorporated by Fred. E. Townsend, Peter Butterly and W. A. Cloutier. The field for electric lighting in the Hempstead district is not only naturally narrow but is also fairly well covered by the electric annex of the Hempstead Gas Company.

Mr. Malcom Peters, General Manager of the Brockton (Mass.) Gas Company, is back again at his post.

Mr. Hall, who it is surmised will eventually receive the contract for locating a municipal electric light plant in the city water works station at Galveston, Texas—as noted in our last, the Special Committee on Lighting having recommended that the contract be so awarded—says that his principal—the Western Electric Company—cannot bind itself to complete the installation under 4 months from the date of signing the contract.

"Mine Host" Atheran, of the Revere House, Oshkosh, Wis., visited the gas company's office the other day for the purpose of paying his gas bill. Having an eye to business, Atheran asked for a rate equal to that paid by another local hotel (the Tremont), but Superintendent Mainlaind refused, unless Atheran would agree to forego electric lights. The gas man did not propose to "stand in the gap," and so declared. The gas rate at the Revere is $2 per 1,000; the Tremont being supplied at $1.75.

The Framingham (Mass.) Gas, Fuel and Power Company has at last been granted a franchise by the selectmen. Its organizers are R. H. Whiting, M. F. Farrell, H. S. Jackson, Jas. W. O'Brien and Jas. H. Tooker, with H. S. Jackson as Clerk and Treasurer. It is capitalized in $75,000, and it is expected that gas will be turned on next September. It is possible that only a fuel gas will be made, and the Fahnehjelm burner be relied on as the converter.

Representative Cochennour has introduced a bill in the Illinois Legislature which prohibits the discharge of the refuse matter from distilleries, glucose factories, and gas works into the streams and lakes under certain penalties. The object is to preserve the fishing grounds of the State, which candor compels us to say are neither large nor valuable.

Recent information from St. Paul, Minn., is to the effect that Messrs. W. A. Dorey, W. F. Palmer, and J. K. Doolittle have submitted to the Council Committee on Gas a petition for an ordinance allowing them to manufacture and sell gas fuel, and to lay their pipes with reference to supplying their customers with the same. The price of gas is put at 60 cents per 1,000 cu. ft. In ten years they stipulate to give the city 20 per cent. of their net profits, and in 20 years the city may have the option of purchasing the works at a fair appraisement. The Gas Committee refused to act on the petition, and referred it to the Committee on Ordinances. The West, it would seem, is enjoying a perfect flood of promises from the fuel gas projectors, who have not as yet reached mediocrity in their performances in this field. We note that the St. Paul coterie freely assert that fuel gas has been successfully used in Philadelphia. Perhaps the Tacony experiment is the one referred to. It would be interesting, by the way, to know who is the real power behind these Western fuel gas speculators.

Despite very stormy weather on the afternoon of the 21st, the Society of Gas Lighting meeting (held at the Nassau works, Brooklyn) was quite largely attended.

Gas Testing and Standards of Light.

The London *Journal*, having alluded to the announcement made by Mr. Geo. Livesey at the recent general meeting of the South Metropolitan Gas Company, that the Board of Trade have in contemplation a measure for improving the system of gas testing as by law established, notes that this is likely to attract the attention of the gas world, and then goes on to say:

It is uncertain, but may be presumed, that the Metropolitan Gas Companies will be the sole subjects of the photometrical reforms to be instituted by the Board of Trade; but experience shows that the methods of the Metropolitan Gas Referees are the pattern for photometrists in every part of the country. It may therefore be regarded as certain that the new practices to be suggested and perhaps legalized at the instigation of the Board of Trade, will have the most serious bearing upon gas photometry everywhere. It is believed that the reforms in question will be directed mainly to two points in photometry—namely, the standard of light, and the photometer itself. With regard to the latter, it is probable that an attempt will be made to reduce to something like order the prevailing confusion of photometer designs. The Board of Trade have followed the disputes between the gas examiners for the metropolis and the gas companies, and desire to put an end to a state of things under which gas may be returned as below standard by one instrument and above it by another in the same house. The type of photometer is to be settled once and for all, so that the uncertainty proceeding from alleged incompatibilities between the Letheby, Evans, and other patterns of these instruments may be eliminated. It must not be overlooked that the photometer is essentially one of the simplest of philosophical instruments.

Sir W. Thompson, making some photometrical observances recently by the aid of a white card, a lead pencil to cast a shadow, and a 2-foot rule, deplored the superfluous complications that had been added to photometers by manufacturers of such apparatus. This is one way of looking at the matter; but it is not the only way. If we mention Sir W. Thompson's remark here, it is only to show that, having regard to the essence of photometry, the selection of a type of the instrument should be a simple matter.

When we proceed to inquire the reasons for those instrumental additions so deplored by Sir W. Thomson, we find that they have been suggested out of regard for a great variety of minor, but still important considerations, which cannot be ignored by anyone who bears in mind the fact that the photometry of gas has a legal as well as scientific significance. We take it that even Sir W. Thomson, if police-court proceedings were a possible consequence of his observations, would prefer to base them upon some more permanent and verifiable apparatus than his favorite card and pencil. The truth of the matter is that the gas photometer is an instrument not to be judged upon one point alone. It is intended primarily for the measurement of the brilliancy of a light of a special character, which may be expected to vary in illuminating power from time to time, but within a very restricted range. The utmost precision is therefore required in all the appointments and fittings of the instrument, in order that its limited readings may not be affected by accidental or structural defects which might be less important if the range of observation were wider. The simpler the instrument the better, of course; and for this reason a gas photometer has been reduced by some authorities to a table carrying the two lights, the graduated bar, the screen, and the meter and clock. The drawbacks to this plan of reducing everything to its elements are that, in the first place, a darkened room must be devoted to the photometer only; and the work of the observer is carried on with less convenience than when he can stand outside his instrument. Hence the many varieties of box photometers have always been more popular than the apparently simple table instrument. The influence of air currents, questions of temperature, etc., have also to be considered. Indeed, so liable are the flames employed in gas photometry to external influences, that to preserve them in all circumstances in what should be their normal rectitude taxes the skill of the most experienced constructor. In undertaking to settle the type of instrument to be exclusively used, it will therefore be seen that the Board of Trade have chosen a task that is as delicate as, if successfully carried out, it will be beneficial to the gas industry.

With regard to the choice of a standard of light to supersede the universally discredited candle, it is almost certain that the Board of Trade will select pentane as the foundation of the new standard; but the form of the standard is not to be so readily anticipated. It may be well to recapitulate the steps that have been taken of late years to procure a settlement of the question of wherewithal the unsatisfactory candle can be replaced in the photometer. It is not necessary now to describe and discuss the various standards based upon molten platinum, the amyl-acetate lamp, electrical incandescent lamps, and others, which for various reasons frequently stated may be regarded as having dropped out of the competition.

The matter has formed the subject of inquiry by a Commission appointed by the Board of Trade, a Committee of the British Association for the advancement of Science, a Research Committee of the Gas Institute, and by Mr. W. J. Dibdin, aided by a corps of experienced photometrists, for the Metropolitan Board of Works. The result of the reports of these investigators has been to narrow the choice of a standard for practical statutory gas testing down to a flame produced by burning the vapor of pentane (a petroleum spirit) mixed with air, or to a portion of light of known brilliancy screened out from a coal gas flame. There are several varieties of applications of both kinds of what may be distinguished as these standard *sources* of light.

The pentane one-candle standard, as originally produced by Mr. Vernon Harcourt, one of the Metropolitan Gas Referees, consisted of a flame of a mixture of 25 per cent. of the vapor of the pentane, which evaporates freely at ordinary temperatures, with 75 per cent. of air contained in a small gasholder. The mixture was easily made by raising the holder (over water) to the height corresponding to the proportion of air required, and introducing the liquid pentane through a siphon or pipette. After standing for an hour or two the pentane vapor would be diffused through the contents of the holder, and could be burnt as a jet exactly equal in illuminating power to a parliamentary standard candle. This is the Vernon Harcourt standard of light as it remains to this day, although various minor modifications have been introduced with the object of steadying the flame, etc.

Next in order comes the Methven two-candle standard, formed of a London Argand 16-candle gas burner. It was soon ascertained that this standard was only constant in value for a limited range of the quality of the gas employed to produce it; and Mr. Methven accordingly im-

proved it by previously carbureting the gas by passing it over a box containing pentane. This rendered the unit practically invariable.

Both of these standards, it will be observed, are of small intensity—in this respect resembling the standard candle. The effect of this dimness of the standard light is the inequality in the normal positions of the standard and the gas flame to be measured by it, with respect to the screen which is to receive equal illumination from them. In a 60-inch photometer, the standard would be 13½ inches from the screen on one side, while the 16-candle gas flame would be 46½ inches distant on the other side. Every error of observation would be multiplied accordingly, and opacity of the air by reason of fog would operate to the disadvantage of the more distant light. It was with a view to remedying this drawback to a dim standard that the late Mr. Keates introduced his 16-candle sperm lamp standard, which failed to find favor, mainly because special care in trimming was needed to make it develop its normal power, and because of the disinclination of photometrists to adapt any standard involving a wick.

Mr. W. Sugg then introduced his 10-candle standard, made of the same burner that is employed in the Illuminating Power Meter, the flame being reduced to a uniform height of 3 inches by a screen cutting off its top. The great convenience of this standard is unquestionable; all the readings from it on the photometer bar being decimal—thus 1.6 would be 16-candle gas, 2.0 would be 20-candle gas, and so on. It shares with the original Methven unit the feature of variability with varying qualities of gas; but unlike the Methven it possesses in the varying consumption required to maintain the flame at its normal height of 3 inches, an indication of the extent of its variability. Consequently by the employment of a correction table provided for the purpose, the standard is made reliable, becoming in this way "a varying standard whose variability is known," as it has been described by a good authority.

Struck by its convenience, Mr. Dibdin has not only paid great attention to this standard in its original shape, but has also rendered it constant, and dispensed with the necessity for correction by carbureting air for burning in it. This has been done in the simplest and easiest fashion, by interposing a box containing pentane between the air container and the burner, it being Mr. Dibdin's contention that air may be effectually pentanized in this way without going to the trouble of preparing a mixture in a gasholder as with Mr. Vernon Harcourt's method. Of course, if it be preferred, the 10-candle standard may be made equally well by the latter method.

Lastly, the conveniences of a powerful photometrical standard and the desirability of establishing equality of the two sides of the photometrical scale, have instigated the production of a 16-candle standard made in the same way as the 10-candle standard, by screening off the top of an Argand flame supplied by pentane air gas, either according to the Vernon Harcourt method or by the Dibdin process of simple carbureting. It is also a subject of study at the present time whether the desired 16-candle standard cannot be made by simply carbureting common coal gas with pentane, just as Mr. Methven does for his improved unit.

The advantages of using pentanized gas instead of pentane air gas are obvious. Pentane air gas is not so easily burnt as coal gas; and there is another question not yet settled, which is the degree of danger involved in the common use of pentane air gas in photometrical work. It is, we believe, unknown how much air is required to make an explosive mixture with pentane vapor. Mr. Vernon Harcourt's pentane mixture cannot be exploded; but the question of the precautions that will be required to prevent anything like the formation of an explosive mixture in the meter and pipes of a testing station in which pentane is constantly used, has never been authoritatively settled. A good deal of experiment with pentane and other standards has been going on at the new Woolwich testing station, where we understand that seven possible standards are in use besides the candle. These are: 1. The pentane single candle jet; 2. The Methven carbureted gas 2-candle unit; 3. The Sugg 10-candle standard with common gas, requiring correction by table; 4. The Sugg 10-candle standard burning carbureted air by Dibdin's method; 5. The Sugg 10 candle standard burning Harcourt's pentane air gas; 6. Sugg's 16-candle standard with pentane air gas; 7. Sugg's 16-candle standard burning Dibdin's carbureted air.

A wealth of data respecting the comparative advantages of these standards must thus be in course of accumulation for the benefit of the promoters of the contemplated bill. It should be stated that a great objection to the use of pentane gas—the trouble of preparing it of the right proportions—has been overcome by Mr. W. Sugg, who has perfected a simple and efficient arrangement for introducing a charge of the liquid under cover into the gasholder. It will probably be found necessary if pentane is used in the London gas-testing stations, to entrust the duty of preparing it to an officer of the Referees, who will make his rounds and keep the gasholders supplied independently of the gas examiners. The above we believe to be a complete statement of the present state of affairs in regard to gas-testing and standards of light in London.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Experience with an Auxiliary Water Gas Plant at Norfolk, Va.

OFFICE OF CITY GAS LIGHT COMPANY OF NORFOLK,
NORFOLK, VA., March 16th, 1889.

To the Editor AMERICAN GAS LIGHT JOURNAL:

A constant reader of your valuable paper, or regular attendant at the conventions of gas engineers needs no reminder to convince him that there has been, and is yet, a very strong prejudice in the minds of many gas men against the use of water gas, either alone or in combination with coal gas. He will also observe there is a growing conviction with some that it may not be so bad as it is represented to be. Those who argue strongest against its use are doubtless one with those who can see nothing in the electric light question that requires a serious consideration from the gas man. While I have never held very radical views of either of these questions, always holding that the gas fraternity should not condemn either too hastily, yet my predilections were never very strongly in favor of water gas in any shape. Two years ago I took charge of these works, finding its plant to consist of a combined water and coal gas process; in other words, about six months in the year water gas alone being made, while for the remainder of the year a combined coal and water gas was furnished. Thinking my experience under these conditions may be of some interest, and tend to remove from the minds of some at least one objection to the use of water gas as an auxiliary, I will as briefly as possible give it.

When, in 1880, water gas—Granger process—was introduced in these works, connection was made to the existing coal gas plant, provision being made by which the water gas was carried direct from *its* washers and scrubbers to the purifiers, which received the combined product when both gases were being made. By this means the coal gas passed through the exhauster and scrubbers and condensers of the old plant, both gases combining at the direct inlet to the purifiers. One of the first troubles encountered was the displacement of water lute in center seal whenever run of water gas was on. This the then Superintendent remedied by filling up partition in lower part of seal and tapping each division for separate overflow. This obviated danger of gas passing, except by regular channel, from box to box, but did not, of course, do away with overflowing or forcing seal of boxes when water gas was being made rapidly, as in case of clean fire in the generator. This trouble continued almost daily, until last season.

The second objection was the effect on the exhauster of the intermittent make of gas. During time of blowing up in water gas plant, while coal gas was being made at rate of, say, 4,000 cubic feet per hour, the exhauster worked regularly; but the moment a run was on, and water gas generated at rate of, say, 13,000 cubic feet additional per hour, a back pressure was thrown on the pipe leading to the purifiers, communicating backward to the exhauster, causing its revolution to more than double. As this occurred at every run of water gas plant it was a severe trial to the exhauster. This I partially remedied the first season by changing the water gas connection with purifier inlet from a Tee-fitting to a Y. While this lessened, it did not by any means do away with the back pressure; neither did it affect overflowing of boxes at all. Having to rebuild our smaller holder last spring, I conceived the idea of arranging the pipes to pass the water gas directly from its plant into this holder, carrying it back from holder to exhauster room, and, by means of a regulating valve, mixing it at the exhauster with the coal gas, thence passing through coal gas condensers, scrubbers, etc., to the purifier. This arrangement did not affect our holder room nor disturb the old arrangement of plant; as, by the manipulation of three valves, we can fall back to old plan of working.

During the past winter the method has worked like a charm. Our exhauster works regularly. We have no overflowing boxes, and, still better, have been able to deliver gas of a more uniform quality; for whereas by the old way we had a gas gradually lessening in candle power after water gas plant was shut down for the night, we now retain enough in the storage holder to continue the mixing process all night. Busy gas men will see the benefit of this. This is not the only benefit we have derived, however. In the endeavor to maintain a good gas during the night, when water gas plant was off, it had been customary to put into the holder in daytime a gas far richer than was needed,

resulting in the use of excessive quantities of oil. That this is true is proven by the fact that with the use of $\frac{7}{10}$ of a gallon less oil per thousand cubic feet of gas made this winter we have made a gas equally as good as in years past, while the standard has been uniform to a remarkable degree.

I have no idea the plan adopted here is entirely original; yet I have not heard of its working elsewhere—neither do I claim it will do away with all objections to the use of water gas as an auxiliary, in all works, but I hold that in case of obstacles such as the combination presented here they can be overcome by a little perseverance.

Yours truly, T. A. Bates.

A Clever Query from a Clever Engineer.

Office of The Excelsior Coke and Gas Co,
Topeka, Kas., March 15, 1889.

To the Editor American Gas Light Journal:

In the discussion following Dr. Norton's lecture, at the late meeting at Boston, Mr. Lamson asked "if some of the other components of the gas would form naphthaline; or whether there were present component parts of naphthaline in some other form."

Dr. Norton replied, "Not after the gas has left the retort."

If it is a fact that there is no naphthaline, as such, in the gas, and yet we take it out of our pipes, etc., sometimes by the bushel, we are forced to the conclusion that it must be formed from the gas itself.

Is it not possible, under favorable conditions, that the benzole may break up and recombine as naphthaline and ethylene?

Thus—$2C_6H_6=C_{10}H_8+C_2H_4$. Yours truly, B. E. Chollar.

A Self-Explanatory Correspondence.

We are pleased to give prominence to the following correspondence series:

New York, 11th January, 1889.

Mr. George Livesey, Chairman South Metropolitan Gas Company, London, England:

Dear Sir—I have read with deep interest your paper presented to the Southern District Association of Gas Engineers on November 8th, and hasten to congratulate you upon again bringing before the gas world an important improvement which will doubtless be found a most desirable adjunct in gas plant construction. You will be glad to know that this subject has been agitated among our gas engineers. I frequently hear your name mentioned with warm commendation, when visiting my gas friends in the north, east, south and west.

I take this opportunity of expressing to you my deep regret at the troubles of the Gas Institute, to membership of which I had the honor of being elected last year. I sincerely trust that wise counsels will prevail and that this most important association identified with the gas industry may retain its proud position. I certainly cannot criticise the action of yourself and associates in the Council. Having been present at the time of the discussion of the Bray matter, I cannot see how you could have acted otherwise than as you did. If it is proper for you so to do, I shall be very glad to get your views as to the outcome of this matter, especially as several of our leading gas engineers are intending to become members of the Institute.

Wishing you a happy and prosperous new year, I remain,

Truly yours, Geo. Shepard Page.

London, January 23d, 1889.

Mr. Geo. Shepard Page, New York:

Dear Mr. Page—I am much obliged for your very kind letter. I have a lively recollection of the pleasure you gave to me and my colleagues of the late Gas Institute when you met us in London last year. The kindly feeling then manifested on behalf of your fellow-countrymen toward their English, Scotch and Irish brethren was a confirmation of what had been previously shown by Greenough, Dresser, Forstall and others in past years. May that kindly feeling always exist, as should be the case between members of one family, and may the only rivalry ever be that of each, in his sphere, striving to the utmost of his ability to maintain and advance the great industry with which we are connected.

I am much interested, among other things, in gasholder construction, and have read with pleasure the various articles on this subject in the American Journal during the past year. I think that great progress must result from so many minds on both sides of the Atlantic being concentrated on the question.

As to the Gas Institute, it is very satisfactory to have your independent opinion of the action of myself and my associates lately on the Council. For six months I carefully abstained from any action or expression of opinion that might have influenced members in any way, in order not to hamper the late President, W. H. Woodall, in his efforts to put the Institute on a satisfactory footing. He, however—capable man as he is—was overruled and resigned. Under these circumstances I cannot advise any gentleman to join the old Institute. The Council, which consisted of 24 members, is reduced to 6. All the Vice-Presidents, Trustees and Finance Committee, the past-President and President, have resigned, while the 6 members left (of whom personally I have nothing derogatory to say), in my opinion, and that of every one with whom I have discussed the subject, must fail. A number of members are only retaining membership in order to vote for the dissolution of the Institute in June. There is a movement on foot for starting a new Institute, as it is felt to be essential to the gas interest, but whether it will be started at once or after June, rests for decision with a Comprehensive Provisional Committee, which is being formed. The *Gas Journal* gives full particulars of the movement. If it should be established, I can say without fear of being mistaken, that the gas men of England will heartily welcome their brethren of America, should they honor us by wishing to become members. With very kind regards, Yours truly, George Livesey.

New York, February, 12, 1889.

Mr. George Livesey, Chairman South Metropolitan Gas Company, London, England.

My Dear Mr. Livesey: I cannot tell you how deeply gratified I was by your exceedingly kind letter of the 23d ult. Knowing the absorbing character of your many duties, I hardly anticipated the lengthy communication which you did me the honor to send. As it came into my office by post, there was with me my most intimate friend on this side of the water, Mr. Emerson McMillin, Vice-President and General Manager of the Columbus Gas Light and Coke Company, of Columbus, Ohio, President of the Western Gas Association and First Vice-President of the American Gas Light Association. He is doubtless known to you through the record he has made since he has been identified with the gas industry and by his papers, several of which have been printed in the London *Journal of Gas Lighting*. He was one of the gentlemen whom the Gas Institute accepted for membership last year. I trust you will not consider I did wrong in reading to him extracts from your letter. I can say frankly it was too good to keep. The sentiments expressed were so characteristic of your own good self and a large majority of the gas engineers of the United Kingdom, that I wish you might give me permission to print the letter.

You will be gratified to know that the gas industry is in an exceedingly prosperous condition in the States, notwithstanding the combined competition of electric light and natural gas. Several of our companies are selling gas at four shillings.

With kind remembrances to my English friends and best wishes for your continued life, health and prosperity, I remain sincerely yours,

George Shepard Page.

London, March 1, 1889.

Dear Mr. Page: Thanks for your kind letter. As to mine of January 23d, I went into the matter so fully in order to make the situation clear to you. You may do with the letter as you please. I am fully aware of the fact that a kindly feeling between American and British engineers really exists and should be promoted by all possible means, both on the ground of our mutual professional interests and of the much larger interests connecting the two nations. As to the proposed new organization, I can say nothing further at present, as nothing has been done. Yours very truly, George Livesey.

Recent Patent Issues.

The following list of recent patents relating to the gas interests is specially reported by Franklin H. Hough, solicitor of American and foreign patents, 925 F street, N. W., Washington, D. C.

Issue of March 5, 1889.

399,087. Apparatus for the Manufacture of Gas. H. C. Shields, Troy, N.Y.
399,104. Gas Burner. F. White, Pittsburgh, Pa.
398,881. Gas Regulator. E. J. Colby, Chicago, Ill.
398,873. Apparatus for Generating and Burning Gaseous Fuel. R. B. Avery, New York city.

Issue of March 12, 1888.

399,497. Combined Gas and Electric Light Fixture. J. C. Cassidy, East Orange, N. J.
399,427. Apparatus for Separating Liquids from Natural Gas. W. Moore, Kokomo, Ind.
399,290. Regenerative Gas Burner. F. Siemens, Dresden, Germany.
399,416. Electric Gas Lighter. E. Kronenberg, Philadelphia, Pa.

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PHILADELPHIA.—PRATT & CO., Corner Ninth and Arch Streets.
Germany.—B. WESTERMANN &CO., of New York.

MONDAY, MARCH 25, 1889.

The German Way of Promoting Industry.

In calling attention to the methods pursued by Germany in the matter of fostering or forwarding industrial pursuits in that Empire, *Engineering* remarks that one cannot but have a degree of admiration for the system, no matter how much he may question the methods adopted, although some of these are very good, and are worthy of imitation. The Society for the Promotion of Industry has just offered 21,000 marks in prizes for solutions of various problems. For the best treatise on mechanical engineering applied to the construction of machinery, 5,000 marks and a silver medal are offered; while 3,000 marks and a silver medal are to be given to the best chemical and physical inquiry into the nature of iron paints most used. The greatest prize is to be given to the most meritorious solution of the point as to how far the chemical composition of, and particularly the amount of carbon contained in steel, is a standard for the usefulness of cutlery and edge tools. The amount offered, in addition to a silver medal, is 6,000 marks, of which 3,000 marks have been granted by the Minister of Commerce; 4,000 marks are to be given for the best description and actual estimate of such lifts as are most generally constructed for hoisting passengers, baggage, and goods in factories, hotels, public and private buildings, arranged after their different kinds, as well as of the necessary safety precautions and their tests, and of the regulations of police and trade companies for the building and management of these lifts, the cost of construction, the working expenses, and necessary space. A silver medal and 3,000 marks are to be given for a description of the chemical processes which take place in producing pure cellular fluid from wood and other vegetable substances by means of soda and other sulphide processes. For the second best answer the Society of Wood Cellular Material Manufactures have offered a prize of 1,000 marks. The time given for the answers is to November, 1890, but in the case of the query regarding iron paints the time allowed is to November, 1894.

Street Work in Winter.

A German engineer, who has given much attention to this subject, has published the results of his observations. He notes that every one knows the difficulty of making any impression with ordinary tools on frozen ground, and a surface protected with paving stones is even more intractable than ordinary material. Unless the fires can be lighted over line of proposed trench, so as to thaw the ground beneath them, the usual way is to pick, painfully and slowly, into the hard, tough mass until a sufficient depth is reached, or the frozen stratum is penetrated. According to Herr Schindler, who has carried his theory into successful practice, much of the labor incidental to such work may be saved by considering that the ground does not freeze all at once into a homogeneous mass, but by successive stages, which produce a stratified condition, something like that of sandstone or limestone. If the work is carried on vertically downward from the surface, the material, whether of stratified stone or frozen earth, must be removed in small particles, while, by taking advantage of the stratification, and working horizontally from a shaft or an exposed face, the material may be split off in large pieces through the seams between the strata. Where the earth has been filled in the strata do not always lie horizontally, but may follow the surfaces of successive deposits of material. Such cases are, however, easily distinguished, and with a little care on this point, after a pit has been sunk in the spot where the excavation is to begin, the operation may be continued rapidly and successfully by means of iron wedges, long and short, which are driven horizontally as the work advances, and lift and break up the frozen earth in large sheets until the necessary depth is attained.

The Market for Gas Securities.

Consolidated bore up fairly well during the weak spell that prevailed in the general market since Friday last, at no time losing more than ¾ of a per cent in the downward range. The trading, too, was very light in this security, although some genuine transactions close to 82½–¼ were recorded. The present conviction is that the next dividend will be at a higher rate than the last, and this belief is shared in by many who seldom engage in financial guessing; but, however, who, when they do don the prophetic mantle, are fortified with the knowledge that the garment will come pretty near fitting them. To-day (noon, March 22) 82½ is bid. We again call attention to the seeming (more nearly described by the word real) cheapness of New York Mutual. It is a purchase at current figures. Brooklyn shares show no marked change, although Citizens is inclined to be a doubtful quantity. Mr. Francklyn and his associates say they mean business in Brooklyn, and not a few "lookers on" predict the possibility of a change of base in their plans—to put it in another way, that control in the People's Company might better suit them.

The feature of the week, however, was the trading on the Exchange in Chicago Gas Trust stocks, and Chicago gas bonds. The Kiernan News (?) Company is devoting much attention to these classes, and is evidently a strong bull, perhaps for cause, on the situation. Whether or not, Chicago Trusts, on large orders said to come from that city, have moved up sharply, the bid price to-day being 48¾. They might offer a chance for profit. Yesterday the dealings in first mortgage bonds of the old Chicago Company footed up $286,000. The opening price was 93, rising to 95, and closed at 94¼. The Equitable bond series may be rated at 99 bid; firsts, Peoples, are 98; a like figure being offered for the seconds. The Boston deal will be completed in a few days; and negotiations looking to a merger of the St. Louis interests are again underway. The Fulton-Municipal (Brooklyn) will pay a quarterly dividend of 2½ per cent. on April 2. The session at Trenton (N. J.) of the current Legislature has been far from unfavorable to shareholders, for the bill providing for the appointment of meter inspectors for Newark and Jersey City has been defeated, a similar fate having overtaken the proposed enactment to abolish the companies' right to charge a meter rental. We may confidently look forward to a general increase in gas share values.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.
16 WALL ST., NEW YORK CITY.
MARCH 25.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	82½	—
Central	466,000	50	—	—
" Scrip	220,000	—	47	57
Equitable	4,000,000	100	112	117
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	118
Mutual	3,500,000	100	98	100
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	125,000	50	35	—
" Scrip	108,000			
Yonkers		50	90	100
Richmond Co., S. I.	300,000	50	55	60
" Bonds	12,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	100	102
Citizens	1,200,000	20	60	70
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	125	127
" Bonds	300,000		—	106
Peoples	1,000,000	10	72	74
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	89	90
Nassau	1,000,000	25	111	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	120	122
" Bonds	1,000,000	—	111	112
Out of Town Gas Companies.				
Boston (Mass.) Gas Co	2,500,000	500	240	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	—	—
" " Bonds	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	43¾	—
Cincinnati G. & C. Co.	6,000,000	100	205	207

Consumers Toronto....	1,000,000	50	192	—
Central, S. F., Cal.....			75	90
Capital, Sacramento, Cal.			58	—
Consolidated, Balt.....	11,000,000	100	45	45½
" Bonds.....	6,400,000		107	107½
Hartford, Conn.....	750,000	25	110	—
Jersey City.....	750,000	20	165	170
Laclede, St. Louis, Mo.	2,000,000	100	—	115
Louisville, Ky.....	2,570,000	50	125	130
Little Falls, N. Y.....	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada.....	2,000,000	100	204	210
Memphis (Tenn.) Gas...	750,000	100	48	51
" Bonds.	240,000	100	103	—
New Haven, Conn.....		25	193	197
Oakland, Cal.....			34¾	35
Peoples, Jersey City...		—	60	61
" " Bonds..			—	—
Paterson, N. J.....		25	90	—
Rochester, N. Y.....		50	75	80
Syracuse, N. Y.....	500,000	25	—	—
St. Louis, Missouri.....	600,000	50	—	—
San Francisco Gas Co. San Francisco, Cal....	10,000,000	100	59¾	60
Washington, D. C.....	2,000,000	20	190	194
Wilmington, Del.....		50	200	208

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Management of a Gas Works,

By a man of many years' experience in England and this country. Or FOREMAN OF LARGE WORKS. Best of references.

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WANTED,

Four 8x10 ft. or 8x8 ft. Second-Hand Purifiers,

With 8 in. Center-Seal and Connections. Must be in good condition, and delivered on or before June 1, 1889.

710-tAp1 Address "PURIFIER," care this Office.

Position Wanted

As Superintendent of Gas Works,

By a man 36 years of age, who has had charge of works for more than 15 years. Best of references. Address

717-4 "PRACTICAL," care this Journal.

POSITION WANTED

As Superintendent.

Have had large experience in the manufacture and distribution of gas, and in the construction of plants. Good references.

Address "SUPERINTENDENT," care this Journal.

MORRIS, TASKER & CO.,

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Builders of Gas Works,

PHILADELPHIA, PA.

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MANUFACTURERS OF
Globe Lamps,
FOR
Streets, Parks, Public Buildings, Railroad Stations, etc.
LAMP POSTS
A Specialty.
Office and Salesroom,
40 & 42 COLLEGE PLACE, - - N. Y. CITY.
Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

The Miner Street Lamps.
Jacob G. Miner,
No. 823 Eagle Ave., New York, N. Y.

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Chas. F. McKenna, Proprietor.
SHELL LIME.
Lime by the Cargo for Gas Purification.
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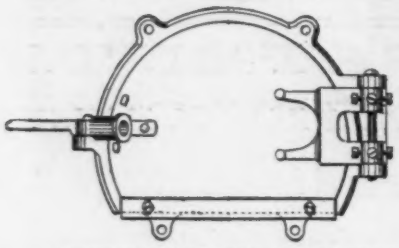
It is to the interest of Gas Companies and Cities to double the efficiency of the light on streets by using Dyott's Patent "CHAMPION" LAMPS. They save 50 per cent. over others in cost of repairs, are ornamental, and indestructible except by violence.
Our Patent System of Instantaneously Lighting Gas (without electricity), for Railroad Depots is unequaled.
Dyott's High Candle Power Burner is a very superior lamp where a concentrated and brilliant light is wanted in Hotels, Stores, Depots, etc.
Special Drawings furnished and Estimates cheerfully given, either from Architects', Engineers', or our Draughtmen's Plans.
We manufacture every description of Plain and Ornamental Lamps, Posts, Brackets, Clusters, etc. Correspondence solicited.

THE BRENNER SELF-SEALING RETORT DOOR.
Simple, Strong, and Durable.
CLOSES ABSOLUTELY TIGHT, & IS LOCKED BY A CAM LEVER. ALL NECESSARY ADJUSTMENT FOR WEAR PROVIDED.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SMITH & SAYRE MFG. CO.,
No. 245 Broadway, - - - - New York City.

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"We have 320 Brenner Self-Sealing Lids in use at this Station, built by the Smith & Sayre Mfg. Co. They require very little attention, and are the best of the kind that I have seen, giving entire satisfaction."

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PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.
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Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

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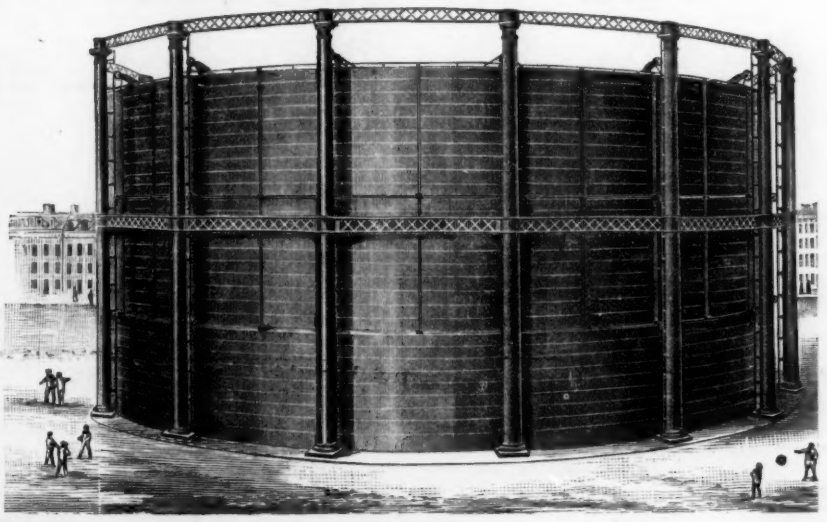

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Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

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THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

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Gas Works Designed and Constructed.

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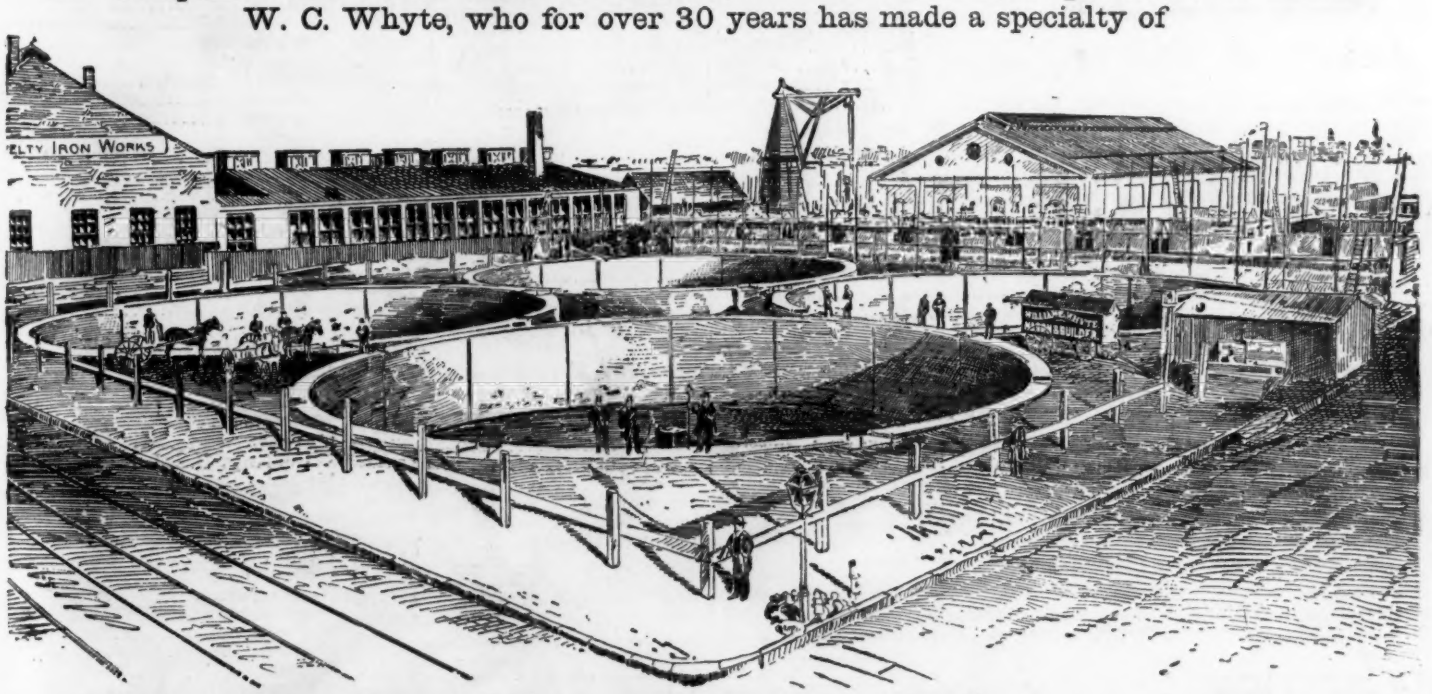

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Fifty Tanks now in operation show the sort of work done. Address

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KIRKHAM, HULETT & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBERS

Erected and in course of construction at present date:

	Capacity, Cubic feet per day.
Altrincham	600,000
Adelaide	800,000
Aldershot	800,000
Allegheny, U. S. A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	800,000
Arcachon	700,000
Animal Charcoal Co.	800,000
Ashford, U. S. A.	250,000
Barton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U. S. A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N. S. W.	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
Banbury	75,000
Birmingham	5,000,000
Brizenheim	2,500,000
Blaichach	1,250,000
Bochum	600,000
Barnstaple	375,000
Boston, U. S. A.	2,000,000
Brisbane	1,500,000
"	500,000
Burton-on-Trent	1,500,000
Bapeaume	750,000
Barking	100,000
Bourlier & Co.	50,000
"	50,000
Bombay	400,000
Buffalo, U. S. A., Wurtzl (Blitzen	750,000
Brooklyn, U. S. A.	500,000
Bergen	750,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U. S. A.	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U. S. A.	1,000,000
"	1,000,000
" Nassau	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	300,000
Croydon	1,500,000
Copenhagen	300,000
Clevedon	300,000
Columbus, U. S. A.	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	2,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co.	100,000
Cadiz	500,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Darmstadt	500,000
Dover	750,000
"	1,000,000
Deal	300,000
Derby	500,000

	Capacity, Cubic feet per day.
Dublin	3,000,000
Dewsbury	100,000
Dessau	500,000
Denton	500,000
Dunedin, N.Z.	600,000
Dresden, U.S.A.	600,000
" "	1,000,000
Dusseldorf	750,000
"	500,000
Dumfries	550,000
Dunedin, N.Z.	600,000
Darlington	1,250,000
Detroit, U.S.A.	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	500,000
Essen	500,000
Elbing	150,000
Falmouth	150,000
Frankfort	500,000
Farnworth	600,000
Exeter	600,000
Frankenthurt	500,000
Forth	400,000
Freiberg	600,000
Goole	250,000
Glossop	500,000
Guildford	500,000
Gloucester	1,250,000
Ham	300,000
Grafton, N.S.W.	100,000
Grag	300,000
Georgetown, U.S.A.	250,000
Goetzau	200,000
Hereford	600,000
Hollywood	125,000
Hay	70,000
Harrow	250,000
Harrogate	250,000
Hastings	150,000
Holborn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Hochheimerwerke	500,000
Haverfordwest	100,000
Halifax, N.S.	350,000
Hanau	200,000
Hilda	400,000
Heidelberg	300,000
Hartford, U.S.A.	1,000,000
Hexton	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Glasgow	100,000
Kensington	1,000,000
Hagel Lyon	300,000

LONDON—

The Gaslight and Coke Co.	
Beckton	12,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
Streatham	1,000,000
Bromley	1,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

	Capacity, Cubic feet per day.
LONDON—Continued.	
Shoreditch	2,500,000
Paneras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co.—	
Greenwich	3,000,000
Woolwich	600,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	500,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
Leominster	150,000
Leiden	500,000
"	600,000
Liverpool	2,000,000
"	3,000,000
"	3,000,000
"	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A.	1,000,000
Louisville "	1,500,000
Long Eaton	300,000
Lille	900,000
"	450,000
"	750,000
"	350,000
"	900,000
Luckenwalde	320,000
Liegenitz	300,000
Lincoln, U. S. A.	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Manissane	1,000,000
Marseilles	1,500,000
"	1,500,000
Metz	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A.	750,000
Magdeburg	500,000
Memphis, U. S. A.	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A.	450,000
Newmarket	150,000
Newark, U.S.A.	600,000
Northfleet	300,000
New York, U.S.A.	2,000,000
Nice	600,000
Newcastle, N. S. W.	200,000
Nimes	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity, Cubic feet per day.
Ober Schlesian	1,000,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W.	100,000
Prescott	100,000
Providence, U.S.A.	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,000,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	600,000
Pawtucket, "	600,000
Quebec	950,000
Radcliffe	750,000
Rouen	950,000
Ramsgate	1,000,000
Rugate	500,000
Richmond, U.S.A.	950,000
Roxbury, "	600,000
Runcorn Soap Co.	95,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	500,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sandviani	1,500,000
St. Josephs, U.S.A.	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A.	2,000,000
"	2,000,000
"	1,000,000
Lachesle	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A.	2,000,000
"	2,000,000
Sheepbridge Coal Co.	50,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A.	750,000
Toronto	1,000,000
Uxbridge	300,000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
Williamsburg, U.S.A.	600,000
"	600,000
Wellington	150,000
Warwick	300,000
Wheeling, U.S.A.	500,000
Walker	300,000
Westgate	100,000
Wilmington, U.S.A.	500,000
Windsor, N. S. W.	100,000
Wolverton	100,000
Wellington, N. Z.	250,000
Whitehaven	125,000
Washington, U.S.A.	2,500,000
Wellaney	75,000
Wetzar	150,000
Warren	200,000
Worcester, U.S.A.	750,000
Yeadon	500,000
Yarrell	250,000

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Adelaide	600,000
Aldershot	200,000
Allegheny, U. S. A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Barntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" " **Citizen**	500,000
Brookline, U.S.A.	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A.	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A.	1,000,000
"	1,000,000
" **Nassau**	1,000,000
Brunner, Mond & Co.	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A.	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Dusselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z	400,000
Darlington	1,250,000
Detroit, U.S.A	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
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Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
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Hamm	200,000
Halle	400,000
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Kidderminster	750,000
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Konigberg	1,000,000
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Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

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Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	560,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W.	100,000
Minneapolis, U. S. A	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A	430,000
Newmarket	150,000
Newark, U.S.A	680,000
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Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000
Ober Schlesian	1,500,000
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"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A.	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
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Roxbury, "	500,000
Runcorn Soap Co.	20,000
Rockhampton, N. S. W.	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland	1,500,000
St. Josephs, U.S.A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co.	600,000
San Francisco, U.S.A	2,000,000
"	2,000,000
Sheepbridge Coal Co.	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
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Toronto	1,000,000
Uxbridge	300,000
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"	600,000
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Walker	300,000
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Wolverton	100,000
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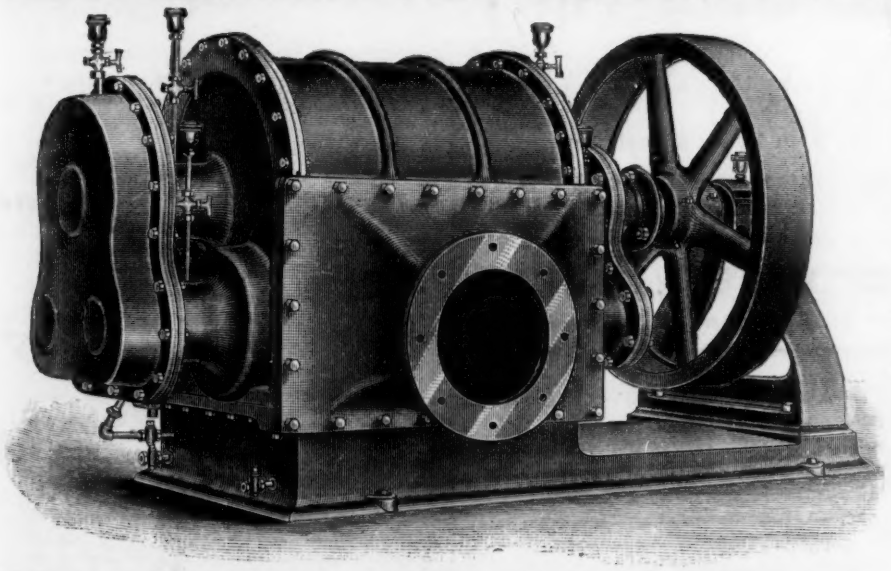

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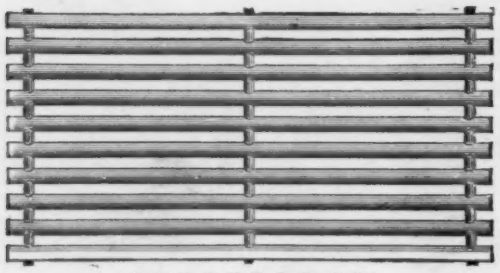

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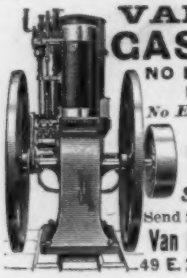

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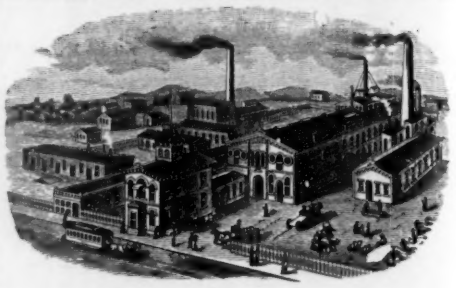

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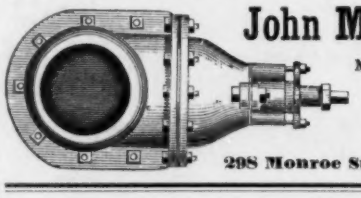

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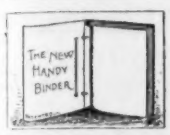

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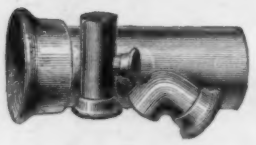

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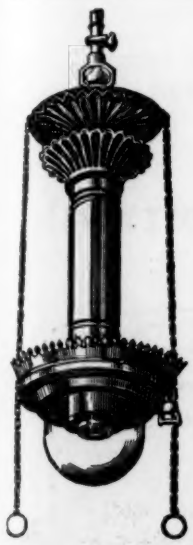

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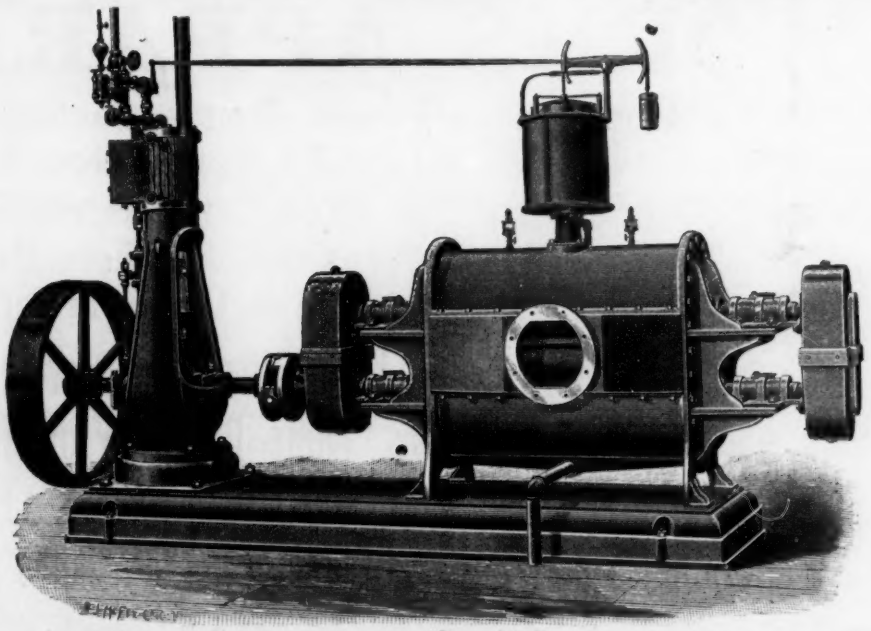

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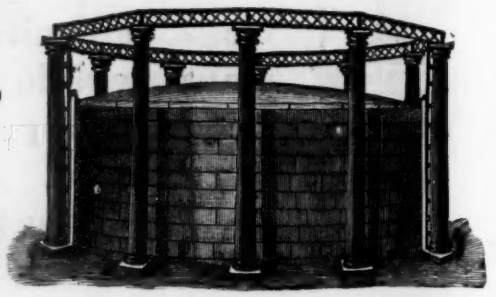

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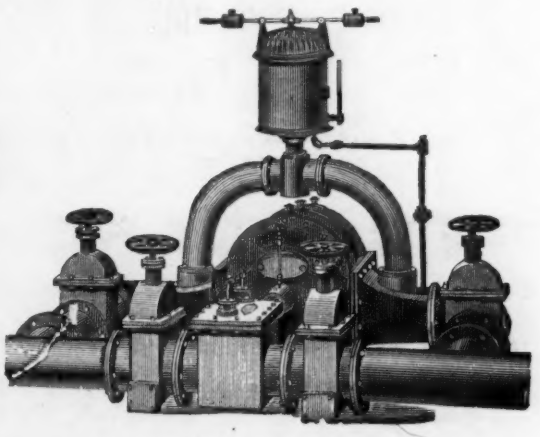

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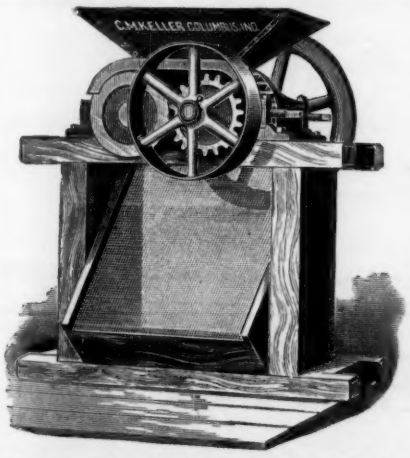

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50-H.P. STEAM ENGINE AND BOILER, Running a Plant of Fifty 2000-C.P. Arc Lamps 12 Hours.	
4,500 lbs. Indiana nut and slack, at $1.30 per ton	$2 93
Engineer, one night, at $50 per month	1 67
Trimmer, one day, at $40 per month	1 33
Superintendent or Electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent, one day, at $40 per year	11
Wheeling coal and removing ashes, at $4 per week	58
100 pairs carbons, at $18.50 per 1000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$10 38

50-H.P. OTTO GAS ENGINE, Running a Plant of Fifty 2000 C.P. Arc Lamps 12 Hours.	
9,200 cu. ft. gas, at 42 cts. per M. (for cost of gas see items below)	$3 86
Engineer not needed; engine is in care of Electrician or Supt.	....
Trimmer, one day, at $40 per month	1 33
Superintendent or electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent dispensed with (cooling water used over and over)	....
Handling of coal included in cost of gas	....
100 pairs carbons, at $18.50 per 1,000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$8 95

Expenses of depreciation, repairs, and interest omitted, being considered the same in both cases—though depreciation and repairs are much higher with steam on account of boiler and its appurtenances. Cost of gas in the holder we estimate for most of the Middle and Western States as follows: Coal, 30 cts.; labor, 20 cts; purification, 2 cts.; total, 52 cts. Less coke, 7 cts., and tar, 3 cts.; leaving net cost of gas 42 cts. The items of Superintendence and repairs, being paid for by the gas sold to consumers, need not be charged on extra output for gas engine consumption. Where the cost of gas is higher than here figured, coal for steam use will be found proportionally higher, and final figures of comparison show same amount of saving.

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